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RICHARDS, O. W., M.A., D.Sc., F.R.E.S. A revision of the genus *Mischocyttarus* de Saussure (Hymen., VESPIDAE) . . . . . 295–462, 4 pls., 119 figs.

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A REVISION OF THE GENUS *MISCHOCYTTARUS* DE SAUSSURE (HYMEN., VESPIDAE)

By O. W. Richards, M.A., D.Sc., F.R.E.S.

Manuscript received 21st March, 1945.

(Read 7th November, 1945.)

With 4 Plates.

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Introduction and Acknowledgements.

During a visit to British Guiana in 1937 [1] a number of species of *Mischocyttarus* was collected of which a considerable proportion were evidently undescribed. Moreover a preliminary study showed that the most important characters for the subdivision of the genus had not previously been noticed. Since it was desirable to describe the interesting nests and larvae, a revision of the species has been attempted, including a study of specimens obtained from other sources.

Dr. J. Bequaert (J.B.) [2] has not only lent me the pick of his collection, with all the species he had already recognised as undescribed, but has also given me the benefit of his advice and criticism. Mr. R. B. Benson has kindly put at my disposal the valuable collection in the British Museum (Natural History) (B.M.) including the material, partly collected by myself, obtained by the Oxford University Expedition to British Guiana, 1929. Dr. H. Bischoff kindly lent the material in the Zoological Museum of the University of Berlin (B.),[3] Dr. H. Sachtleben that in the Deutsches entomologisches Institut, Berlin-Dahlem (D.E.I.), Dr. C. F. W. Muesebeck some of that in the U.S. National Museum (U.S.N.M.), Prof. G. D. H. Carpenter that in the Hope Department, Oxford University Museum (O.), and Dr. V. S. L. Pate that in the collection of the Department of Entomology, Cornell University (C.). Mr. J. D. Cleare, Jr., sent, through the Imperial Institute of Entomology, certain specimens from the collection of the Dept. of Agriculture, British Guiana. M. L. Berland

[1] The visit was made possible by a grant from the Leverhulme Trustees. The party consisted of my wife and myself, Mr. N. Y. Sandwith (Royal Botanic Gardens, Kew), Dr. J. Smart (Natural History Museum) and Miss J. Smart.

[2] The initials in brackets following each acknowledgement in the present paragraph indicate the abbreviation later used in the text when referring to the source and usually also the destination of specimens mentioned.

[3] These specimens are at present in this country, but it is hoped to return them to Berlin eventually. I am indebted to Mr. F. Griffin for bringing them over originally.

kindly allowed me to examine a number of specimens in the Muséum national when I was in Paris in 1938. To all these gentlemen, to the Leverhulme Trustees and to my partners in the expedition, I wish to express my thanks. All the photographs on plates 1–4 were taken by my wife and any dissections of wasps, mentioned later, were made by her.

2. Classification of the Genus.

Mischocyttarus was erected by Saussure to include the group of species allied to *M. labiatus* (Fab.) which are unusually elongate and have a characteristic colour. Ducke (1904) founded the genus *Megacanthopus* for species which had been placed in *Polybia* but had nesting habits like *Mischocyttarus* and shared with them the peculiar asymmetrical hind tarsi (cf. figs. 57, 68). Later, Ducke (1918) united all these species under *Mischocyttarus* and this seems to be the right course even if it is admitted that there are several distinct groups within the genus. The genus had been recognised as a biological unit, without morphological definition, by H. von Ihering (1896).

Mischocyttarus is a characteristic American (almost entirely S. American) member of the subfamily Polybiinae.[4] Its separation from the other Polybiinae is based primarily on the asymmetrical tarsi but the distinct prepectal suture and normally narrow first abdominal tergite are only shared by a few other genera. Reid (1942) described the larval Vespidae which we obtained in British Guiana and he shows that the larval stage of *Mischocyttarus* is also very distinct, possessing characteristic ventral lobes on the first abdominal segment and an enlarged first spiracle. In my opinion, it would probably be correct to unite the Polybiinae with the Polistinae (the latter name taking precedence). In neither the adult nor the larva does *Polistes* seem to me to be more distinct from the Polybiinae than is *Mischocyttarus*. The general biology, also, seems to be fundamentally similar.

The principal characters for the subdivision of the genus were indicated in a previous paper (Richards, 1941). All the new characters used are illustrated in the present paper. The more important are listed here, together with a reference to the appropriate text-figures.

Head.	Black markings of head—fig. 108.
	Tentorial pits—fig. 1.
	Ratio POL : OOL—fig. 106.
	Occipital margin—fig. 29.
Thorax.[5]	Anterior margin of pronotum—figs. 8, 67, 76.
	Pronotal fovea—figs. 67, 76.
	Flange of front coxa—figs. 12, 56.
	Proepisternum, anterior margin—figs. 9, 38, 79.
	Metapleuron, process of upper division—figs. 10, 39.
	Proximal rings on fore and mid femora—fig. 23.
Propodeum.	Plate of valve—fig. 40.
Abdomen.	First abdominal segment, spiracular ratio—fig. 4.
	First abdominal segment, membranous emargination—figs. 11, 25.
	Male genitalia are fully described for *M. superus* Rich., p. 414, figs. 83–8.

[4] For the subfamily divisions of the Vespidae see Bequaert (1918).

[5] The anterior margin of the pronotum and of the proepisternum may be difficult to see if the head is in a bad position.

3. Variation in Colour and Structure.

Many of the species vary considerably in colour, especially the species with the recurrent black (brown) and yellow pattern.[6] Some of this variation is of the same type as has been shown to be due to the effect of temperature in *Polistes*, etc., and such variation may be found in a single locality. Variation which is sometimes less marked though more constant often differentiates series from different geographical regions. In *M. collarellus* Rich. (p. 421) a variety occurs amongst the inhabitants of a single nest which very closely resembles what is a geographical race in the closely related *M. collaris* (Ducke). For this reason, following the practice of Dr. J. Bequaert, all the variations to which names have been given have been described as " varieties " though most of them will probably be found to be subspecies. Some authors hold that varietal names have no standing in nomenclature; anyone who thinks it necessary can redescribe as subspecies the forms here recorded as varieties.

I have a suspicion that one cause of some of the puzzling variation in neotropical Vespidae may be due to some colonies being founded by one queen, others by more than one. In *Mischocyttarus* (cf. p. 299) most colonies are founded by a single queen, sometimes accompanied by one or two workers, and the inhabitants of the nest are all brothers and sisters. There are, however, indications that there may sometimes be more than one egg-laying female in the nest and this might well account for greater variation. I believe that a test case for this suggestion would be the Polybiine genus *Apoica* Lep., which is rather markedly variable within any district but uniform within the nest. I suspect that in this species there is only one egg-laying female, but unfortunately we did not find any nests in 1937 and no dissections of this species seem to have been made. In the forms of *Mischocyttarus alfkenii* (Ducke) inhabiting Paraguay, Bertoni (1911 : 127) notes that there is much local colour-variation but that each nest is uniform.

Besides variation in colour, I have also recorded it in certain metrical characters. When a variety has been segregated on colour-pattern, it is a valuable confirmation to find that the metrical characters which are quite independent also differ. The characters measured in all species are : (1) Length of fore-wing from the centre of tegula, measured to the nearest half-millimetre. This is a convenient measure of the size of the species. (2) The number of hamuli (hooks on the anterior margin of the hind-wings). This is usually loosely correlated with size. (3) The condition of the dorso-lateral margin of the valve-plate of the propodeum. In some forms this margin is regularly rounded (obtuse), in others it is just a right-angle (subacute), in others sharp or raised into a slight lamella (acute). Tables of wing-length and hamuli-number are found on p. 453.

These three characters are occasionally useful in identifying species or subspecies, *e.g.*, the hamuli in separating *M. labiatus* (Fab.) and *M. melanarius* (Cam.) or the wing-length in recognising var. *flavicornis* Zik. of *M. basimacula* (Cam.) or in separating *M. collarellus* Rich. from *M. collaris* (Ducke).

Some time was devoted to examining the distribution of metrical characters to see if they formed " clines," *i.e.* were arranged in some regular geographical way independent of or complementary to subspecific variation. In most species insufficient material was available and the locality data are often insufficiently precise. There seems little evidence for the existence of clines in the characters measured with the exceptions noted below.

[6] Fig. 108 shows the standard type of markings on the head of a black and yellow species, with the names I have given to the markings.

M. drewseni Sauss. (p. 328) has a subspecies *gigas* in the Argentinian province of Jujuy. It is partly characterised by long wings and numerous hamuli (♀ means, wing 16·0 mm., hamuli 16·5). *M. drewseni* over the greater part of its range has ♀ means 14·5–14·8 mm., 13·1–13·9. In Paraguay, however, the hamuli become much more numerous (♀ mean 18·0) though the wings are hardly longer (♀ mean 14·1 mm.). There is perhaps a suggestion here of leakage of genotypes from the area of *gigas*. The related species *M. rotundicollis* (Cam.) shows no such variation though its range is almost the same. It was noticed (p. 325) that in *M. labiatus* (Fab.) the margin of the propodeal valve-plate is usually acute in British Guiana and to the eastwards but usually more obtuse to the west. This variation is not apparently associated with definite subspeciation, but is correlated with a greater number of hamuli. Wing-length retains the same mean.

4. General Biology.

(a) *Reproduction.*

It has been the usual practice, after separating off the Polistinae, to divide the remaining South American social wasps into two biological groups, the "monogynous" or "monogamous" species which includes the genus *Mischocyttarus* s.l. and the remaining Polybiinae which have been called "polygynous" or "polygamous." These terms are unfortunate, since, according to the dictionary, both polygamous and polygynous mean one male having several wives. The number of females fertilised by one male Polybiine is unknown and the terms polygamous or polygynous should not be used to describe nests in which more than one egg-laying queen is present. For this condition the word pleometrosis (adjective pleometrotic) coined by Wheeler is available; the alternative condition, characteristic of *Mischocyttarus* and *Polistes*, where there is usually only one egg-laying queen, is termed haplometrotic.

The typical pleometrotic Polybiines found new colonies by swarms composed of many workers and one or more queens. Most *Mischocyttarus* nests are founded by single queens. Outside the Vespidae (*Apis*, Formicidae) there is no necessary connection between the foundation of nests by swarms and pleometrosis; it is probable that there is no necessary connection in the Vespidae, though the existing information suggests that the correlation is high. In my view each type of behaviour is principally an adaptation to the same need, mobility of the colony and speed in reconstruction after a colony has been destroyed. If one queen lays all the eggs, as in *Vespa*, she soon becomes immobile owing to a physiological degeneration not perhaps essentially different from that seen in a more advanced form in the queen termite. A group of queens each laying a smaller number of eggs does not become immobilised. Moreover such a group can restock a nest with eggs in a few hours. Finally, the workers in the swarm can make a new nest in one or two days. I believe all these measures are necessary to overcome the difficulties of living in regions where ants, especially driver ants (Ecitoninae), are dominant. This view was reached during a study of British Guiana Polybiinae, the results of which will be published later.

None of the previous explanations of pleometrosis and swarming which I have read has seemed to me convincing. It is usually stated that they are an adaptation to tropical conditions of optimal nutrition with a climate which does not enforce the annual destruction of the colony. It is not clear, however, that the favourable conditions would not be more fully exploited by a larger

number of nests each with single queen, if necessary helped by a few workers (*i.e.* monometrotic swarming such as occurs in some tropical *Polistes* and *Mischocyttarus*). On the views put forward in the preceding paragraph *Mischocyttarus* has met its difficulties in a different way. (1) *Mischocyttarus* colonies are always relatively small. While as many as 200–300 cells have occasionally been reported, particularly far south of the equator (e.g., *M. cassununga* near Rio, p. 378), most colonies have less than 50 cells and the eggs to fill them are produced quite slowly. (2) A number of species (see p. below) have entered into some sort of association with ants and found safety by firmly grasping the nettle. (3) Tropical nests of *Polistes* which I have examined have all been relatively small and it would appear that larger nests are found outside the tropics. A small nest implies that the queen does not lose mobility and that not much capital is lost if the nest is abandoned.

There are a number of points which are still in need of investigation and some of these are crucial to any complete theory of the reproduction of tropical VESPIDAE. First, little is known of the nature of Polybiine swarms. From personal observation, it is clear that a swarm may be merely all the adult inhabitants of a nest. But it is not known by observation that part of a colony may be budded off as a swarm and, if so, what is the composition of a swarm, particularly the age of the queens taking part in it. Second, there is no information as to the length of life of Polybiines and very little as to the persistence of individual nests. It is not clear how far the size of the *Mischocyttarus* colony is limited by the egg-laying life of the single queen. It is possible that the simple type of nest could not be expanded beyond a certain size; this is suggested by the fact that cells begin to be used a second time even when a colony is quite small (see *M. cassununga*, p. 378, and *M. ater*, p. 354). Some of the other Polybiine nests seem to persist for a long time, possibly years, but if there is a limiting factor, it is not known whether it is the size of the nest, the contamination of the comb when cells have been frequently re-used, the length of life of the queens or merely the incidence of destruction by ants, birds or weather. Third, there are suggestive hints that Polybiine nests become larger both for the group as a whole and within a single species at the northern and southern limits of their range. Here, too, colonies undergo some form of quiescence or hibernation. It seems possible that the size of the colony is related in some way to the frequency and type of swarming and that investigations at different latitudes might do much to clear up this problem. Finally, *Vespa*, the haplometrotic genus *par excellence*, has a number of species in the Indo-Malayan tropics, and a full account of their biology would be of great interest.

Data as to colony-founding in *Mischocyttarus* will be found under *M. lecointei* (p. 406), *M. metoecus* (p. 411), *M. superus* (p. 423), *M. collarellus* (p. 421), *M. collaris* (p. 416) and *M. surinamensis* (p. 435). It is clear that many nests are founded by a single queen and probably never have more than one before the colony disbands. Other nests, so small that there are only two or three half-made cells, empty or containing eggs only, are inhabited by a queen and a few workers. Such nests have probably been founded by a small swarm. Perhaps in some cases, as suggested by Rau (1933) and Bequaert (1933), a queen founds a nest and is afterwards joined by other individuals. Rau has shown that this may occur in *Polistes*. It is not known whether these later individuals come from other colonies; I should require good evidence before believing that individuals from several quite disconnected colonies would work together.

There is no certain evidence that a *Mischocyttarus* colony ever has more than one egg-laying queen. Two nests of *M. lecointei* (p. 410) whose inhabitants we dissected had two queens but as the material had been preserved in spirit it was not possible to say that both were fertilised. I strongly suspect that in some nests two or three queens may be present as seems, sometimes, to happen in *Polistes*.

There is another phenomenon which may be a consequence of pleometrosis, viz. the slight differentiation of the worker caste in the Polybiinae. In *Vespa* nearly all workers are sharply separate in size from the queens and may differ also in colour. Most specimens can be put into one category or the other at a glance. In the Polybiines it is usually difficult and sometimes impossible to distinguish the workers and queens without dissection. The ovaries, however, in most genera differ sharply, those of the queen containing eggs in all stages, while those of the worker are rudimentary. It is perhaps best, in view of the peculiar conditions found in some genera such as *Stelopolybia*, to define a queen arbitrarily as an individual whose spermatheca contains sperm. In two species of *Mischocyttarus* (*M. superus*, p. 425, and *M. lecointei*, p. 411) enough individuals were dissected to make a comparison possible between queens and workers. Superficially they seem quite indistinguishable, though in *M. surinamensis* FitzGerald (1938) thought he could recognise queens by their larger size and relatively wider heads. There seemed some evidence that the two castes might differ in the average number of hamuli but the evidence is inconclusive.

Finally, there is a marked difference between pleo- and haplometrotic species in the relative frequency of males, though this appears to be due almost entirely to the greater number of workers in pleometrotic species. The ratio of queens to males is not very different in the two groups. Table 1 gives the relevant data from specimens captured in British Guiana in 1937.

Table 1.

Numbers of queens, workers and males in Polybiine colonies.

Nature of material	Genus	No. of species	No. of nests	Queens *	Workers *	Males
Specimens caught away from nest	*Mischocyttarus*	—	—	24		4
All specimens included in present paper	*Mischocyttarus*	63	—	1059		276
Nests with no males	*Mischocyttarus*	10	58	45	45	0
Nests with one or more males	*Mischocyttarus*	5	7	6	7	9
Other Polybiines caught away from nest	12 genera	32	—	358		3
Other Polybiines, nests with no males	7 genera	12	55	993	10,391	0
Other Polybiines, nests with one or more males	3 genera	8	14	226	16,247	447

* In *Mischocyttarus* some dissections were made of *M. lecointei* (p. 411) and *M. superus* (p. 425) which suggest that, on the average, workers and females occur in equal numbers in this genus. In the other Polybiines a sample (usually 100 wasps) from each nest was dissected and the numbers are estimated from this. It should be noted that the queens listed are egg-laying females and that the young unfertilised queens may, at least in part, be confused with workers. The most striking fact in the table is the abundance of the workers in the pleometrotic species. Apart from this, the proportions of males and queens do not seem to be widely different, considering the errors of such a generalised table.

(b) *The nature of the nest.*

The nest of *Mischocyttarus* is always made of paper derived either from dead wood or, apparently, from dead leaves. The material is not nearly so finely comminuted as in the genera allied to *Polybia* or in *Polistes*. The whole outer surface is more or less varnished, possibly with saliva, while the darker shining varnish on the petiole is perhaps partly of vegetable origin. In most species occasionally and in some regularly (*M. metoecus*, p. 411), " windows " are left in the paper. These are either holes or gaps in the paper covered by varnish only. In Saussure's classification the nests of *Mischocyttarus* are described as gymnodomous and stelocyttarous, *i.e.* they consist of a single stalked comb not surrounded by an envelope, just as in *Polistes*. One *Mischocyttarus* nest was found with a rudimentary envelope. Only an immature adult was obtained so the species is not described but referred to as " species 10 " (p. 430), closely allied to *M. surinamensis* (Sauss.). There is a conical envelope, widely open at the bottom and distinct from the outer walls of the cells. Such a nest is not known in allied species and the envelope appears to be merely a specific peculiarity. The nests of the other S. American Polybiines are enclosed in an envelope except in *Gymnopolybia* which builds in cavities in trees, etc., and in the anomalous genus *Apoica*.

In the descriptions of the nests the following terms are used. The stalk is called the *petiole*. The petiole is attached to a leaf, root, etc., by a small disc of paper, moulded to the surface, the *plate of attachment*. Sometimes the petiole is *buttressed* on to the plate with small lateral expansions. In some nests the petiole arises directly from the first constructed cell, but in others, especially large ones, it is expanded into a *cone of attachment*, including the bottoms of several cells. The closed end of the cells to which the petiole is attached is termed the *proximal* surface of the comb, while the open ends of the cells form the *distal* surface of the comb. The comb seems always to start with a single cell and usually others are only added as they are required for eggs, so that cells not containing eggs, larvae or pupae are infrequent. There is, however, a suggestion (*M. superus*, p. 425) that when the queen is helped by workers, cell-formation may get ahead of oviposition; otherwise, empty cells seem to imply that the colony is disbanding. It is possible that important characters for the classification of nests might be derived from the order in which the cells are constructed, so that combs of similar final appearance might arise in different ways. The information on this point is very scanty; fig. 136 shows the order in which I think the cells of a comb of *M. labiatus* were constructed, in this species in a spiral. In nests with a strongly eccentric petiole, such as *M. collarellus*, new cells are added in a curved row along the edge of the comb farthest from the petiole. It will usually be found that the cells are arranged in rows in two principal directions and this enables a formula to be constructed to describe the comb, *e.g.* $\frac{4\text{ P.}, 5, 5\ (2\text{ C.}), 4, 3, 2, 1}{3\text{ P.}, 3, 4, 4\ (2\text{ C.}), 3, 3, 3, 1} = 24$ describes a comb of twenty-four cells. In one direction there are 7 rows of 4, 5, etc., cells, in the other 8 rows of cells. The petiole is very eccentric since it occurs in an outer row in each direction; two cells near the centre contain cocoons.

Eggs are usually laid at the side of the cell when the cell is small and the cell-walls are built up as the larva grows. There is some evidence that the position of the egg, whether at the bottom or the side of the cell and whether on the side nearest to or farthest from the petiole, is taxonomically important, but much more observation is needed on this point. The cocoon is merely a

dome of silk spun across the mouth of the cell by the larva and attached about 1 mm. inside the cell-lip. The silken lining of the rest of the cell is almost imperceptible. When the dome is complete the wasps usually bite away the outstanding lip of the cell and plaster this and perhaps other paper over the silk. The silk may be completely covered but more often it is camouflaged with criss-cross lines of paper.

There is little information as to the rate of growth of nests. FitzGerald (1938 : 185) records in *M. surinamensis* that a nest of 1 ♀, 3 ☿ and 15 cells added only 3 cells in a fortnight while four larvae pupated in this period. In Table 4 (*M. lecointei*) where 22 nests are analysed, it is shown that pupae were not present in cells with less than 16 cells while larvae were not found in nests of less than 7 cells. To complete the picture, however, we still need to know the length of the egg and larval periods.

When Reid (1942) made an independent study of *Mischocyttarus* larvae, a very good agreement was found between his classification and one based on the structure of the adults. It was hoped that it might be equally easy to obtain a classification of the nests which would show a similar agreement. In the event, however, a classification based on the nests alone would diverge widely from one based on their inhabitants. Certain features, *e.g.* the long petiole in *Mischocyttarus* s.s., the broad flattened petiole in the group of *M. ater*, the triangular comb with flattened sides in the group of *M. collaris*, are completely or partially correlated with the characters of the adults, but there are usually exceptional nests in some species which have no outstanding structural peculiarities in the wasps. Moreover, there are several cases where adult wasps which are structurally very similar make totally different types of nest, viz. *M. oecothrix* (fig. 448) and *M. synoecus* (fig. 450), *M. metoecus* (fig. 411) and *M. lecointei* (fig. 406). Again the long thread-like type of nest turns up in several unrelated species of the genus. I have regretfully been forced to give a very subordinate place in the classification to the nest-structure; it is better to classify the wasps and then see if their nests have any features in common, rather than to attempt an independent classification of nests. The point is one of great importance in the classification of the POLYBIINAE since Ducke largely used nest-structure in devising the classification and to some extent made his genera for any group in which the type of nest was widely different.

(c) *Food.*

Almost nothing is recorded of the food of *Mischocyttarus* and the wasps do not seem to be found on flowers. Presumably the larvae are mainly fed on chewed-up insects. In three species (*M. injucundus*, p. 349; *M. ater*, p. 352; and *M. cerberus* var. *acheron*, p. 442) drops of a substance resembling honey have been found at the mouths of some cells in certain nests. Rudimentary honey-storing has also been recorded in *Polistes* while *Nectarina* (POLYBIINAE) collects honey on a big scale.

(d) *Habitats, mimicry, enemies.*

In the immediate neighbourhood of the Mazaruni Settlement, British Guiana, three principal habitats may be recognised, viz. *clearing*—an open savannah-like area, at least partly cleared by man in the neighbourhood of the settlement; *second growth*—low, rather open, forest growing where much tree-felling and burning have greatly modified the original vegetation; and *high forest*—tropical rain forest somewhat modified by selective felling but

substantially not a man-made vegetational type. Some of the other areas in which collecting was done could easily be fitted into one of these three types. On the other hand, travelling farther afield in Guiana, other types would have to be recognised, *e.g.*, " Wallabah bush " (forest dominated by species of *Iperua*) seems to have a different fauna from other high forest (*e.g.* the var. *guianensis* n. of *M. lecointei* (Ducke)). On the slopes of the Kaieteur escarpment is a forest intermediate between high forest and second growth, in that it is shorter and lighter than the former but little interfered with by man and lacking many characteristic second-growth plant-species. This will be referred to as " intermediate " which seems to describe it so far as the insect-fauna is concerned though unfortunately it cannot be characterised botanically. In Table 2 is recorded the habitat in which nests and stray individuals of *Mischocyttarus* were found. No species was found in all four and some were only found in one. In the same table the habitat range is shown of those Polybiines which some of the *Mischocyttarus* species resemble very closely in colour. It will be seen that there is a good agreement in distribution between the Polybiinae models and the *Mischocyttarus* mimics (the use of the terms model and mimic is discussed in a later paragraph), but in general the models are more widely ranging. In the table the models are numbered 1 to 7 and the numbers following the *Mischocyttarus* species show which model they resemble.

Table 2.

Distribution of *Mischocyttarus* and their Polybiine models into habitat types. " n." = nest.

Species of wasp	High forest	Intermediate	Second growth	Clearing	Model or mimic
Mischocyttarus labiatus	—	♂, 3 ♀	♂, 3 ♀	2 ♂, 4 ♀	—
M. flavicans	♂, 2 ♀	—	—	—	5
M. carbonarius	—	4 ♀, 2 n.	—	—	4
M. heliconius	2 ♀, 1 n.	1 n.	—	—	—
M. injucundus	—	—	—	4 n.	7
M. alfkenii	—	—	—	1 ♀	2 & 3
M. lecointei	—	3 ♀, 20 n.	2 n.	1 ♂	1
M. metoecus	—	—	6 n.	—	1
M. prominulus	—	—	1 n.	—	2 & 3
M. surinamensis	—	1 n.	1 ♂, 1 ♀, 1 n.	—	2 & 3
M. cerberus	—	—	—	2 ♀, 6 n.	2 & 3
M. oecothrix	1 ♀	1 n.	—	—	1
M. synoecus	1 n.	—	2 n.	—	2 & 3
M. foveatus	1 n.	—	—	—	6
Gymnopolybia vulgaris	1 n.	2 ♀	23 ♀	2 ♀	1
G. cayennensis	—	—	1 ♀	12 ♀	2
G. pallipes	1 ♀	—	13 ♀, 1 n.	♂, 10 ♀	3
G. angulata	—	13 ♀	39 ♀	5 ♀	4
G. testacea	10 ♀	—	—	—	5
Stelopolybia infernalis	4 ♀, 2 n.	6 ♀, 1 n.	31 ♀, 2 n.	3 ♀	6
Polybia rejecta	—	—	2 ♀	19 ♀, many n.	7

Colour resemblances between different species of South American wasps and between them and other insects have been noted by many authors. Schrottky (1915) has recorded the group centring round *Gymnopolybia angulata* (Fab.). This includes besides *Mischocyttarus carbonarius* (Sauss.), a *Polistes*,

two *Polybia*, a *Pachymenes* and a *Montezumia* in the VESPIDAE, an *Odyneropsis* (APIDAE), *Pseudosphex ichneumonea* H.-S. (Lep., SYNTOMIDAE) and *Polistomorpha sphegoides* Walk. (Chalcidid). In the moth, the correspondence in geographical range is fairly close and the species is relatively rare. All the species live in dark forest. Ducke (1910 : 460) gives a list of five large colour-groups made up of insects of different families.

Salt *in* Poulton (1931 : 19) found another Syntomid, *P. strigosa* Druce ♂, which closely resembled *Mischocyttarus ater* (Oliv.) at Rio Frio, Colombia. The resemblance was marked even after capture. Ducke, of course, noted the more striking examples of resemblance of *Mischocyttarus* to other POLYBIINAE, *e.g.* (1907 : 35) *M. flavicans* (Fab.) (= *goeldii*) to *G. testacea* (Fab.). FitzGerald (1938) noted the general tendency for species of *Mischocyttarus* to resemble other Polybiines in Trinidad. He remarks (: 183–4) of *M. surinamensis* (Sauss.) that the straw-coloured nests are conspicuous under eaves of houses, etc., and that the bright yellow colour of the wasps sitting on the nest increases the effect; but that as the species resembles the aggressive *G. pallipes* (Oliv.) this may be an advantage. Bequaert (1933 : 139) records that the Syrphid *Salpingogaster punctifrons* Cress. resembles *M. cubensis* (Sauss.) in Cuba.

Bequaert (1933) describes the geographical variation of *M. flavitarsis* (Sauss.) (see p. 359) and notes that there are several regions in the Western United States, each with a special colour-form of the *Mischocyttarus* and with similarly coloured forms of *Polistes* and other insects. He describes this phenomenon by the useful non-committal term " homoeochromatism."

There can be no doubt of the fact that there are large numbers of colour-resemblances amongst South American wasps, due to convergence rather than to affinity, and that a number of insects of other groups—Diptera, Coleoptera, etc.—are also involved. As far as the wasps concerned, it is probable that part of these resemblances are due merely to the limited number of colour-patterns available within the group, *i.e.* to permutation of a restricted number of phenotypes. But it is also clear that such permutation can only explain part of the data and in particular is less likely so far as insects of other Orders are concerned. The association of similarly coloured forms in the same habitat (Table 2) is important; the occurrence of nests of *M. injucundus* (Sauss.) on the same tree as those of its model *Polybia rejecta* (Fab.) (p. 352) was very striking. Moreover, the principal " models," particularly *Gymnopolybia*, are all aggressive species, easily provoked to attack and giving a severe sting. The *Mischocyttarus* do not attempt to defend their nests and have a relatively weak sting. The species of *Gymnopolybia* appear to be general predators and carrion feeders and are found ranging very widely searching for food. The other POLYBIINAE may be to a large extent nectar-feeders or else specialised hunters of winged ants and termites. As a result, a far higher proportion of *Gymnopolybia* are found in general collecting than of the other species which are much less often found away from their nests (see Table 3).

The value of the species of *Gymnopolybia* as possible " models " lies then not only in their aggressiveness and powerful stings but also in their greater conspicuousness (and possibly also greater numbers) in the general wasp fauna. The only *Polybia* model in Table 2 is one which had constructed many nests on one tree and the *Mischocyttarus* was confined to the same tree. No doubt so far as mimicry is involved, it is of the Müllerian variety; that is, most members of the group are more or less protected and all add a little to the value of the warning pattern.

But while these conditions are such as might well lead to the development

of mimicry, this is by no means a proof that the resemblances can be explained in that way. For this, observations are required on the behaviour of birds or of other predators with sufficient powers of discrimination. At the present moment very little information as to the insect food of S. American birds is available and probably none as to whether insectivorous birds tend to avoid the models and to mistake the mimics for them. One difficulty seems to be that the aggressive spirit of most of the wasps is only adequately called forth in the defence of their nests; they are much more timid when found flying in the forest where opportunities for confusion between model and mimic will be most frequent.

I have already stated (p. 299) that some species enter into relations with ants. Probably no species can placate the driver ants; when they appear,

TABLE 3.

Proportion of " strays " to nests in POLYBIINAE in Guiana, 1937.

Genus and species	Strays, caught flying in forest, etc.	No. of nests found	Ratio Strays/nests
Mischocyttarus, 15 spp. .	7 ♂, 27 ♀	69	0·5
Gymnopolybia, 7 spp. . .	1 ♂, 135 ♀	2	68·0
Stelopolybia, 2 pp. . .	62 ♀	5	12·4
Protopolybia, 4 spp. . .	25 ♀	11	2·3
Polybia, 11 spp. . .	2 ♂, 67 ♀	59	1·2
Various genera, 7 spp. .	46 ♀	10	4·6

the only policy is to abandon the nest and to start a new one after they have passed (as was seen to happen in the Polybiine *Parachartergus apicalis* (Fab.)). But there are many ants of other groups of which a colony may inhabit a whole tree and these are likely to render it unsuitable as a site for a wasp's nest. This view is supported by the observation that most species do not live on such trees, whereas a few are often or even almost invariably found on ant-trees. Examples of such wasps are *M. lecointei* (Ducke), p. 409, *M. metoecus* Rich., p. 412, *M. collaris* (Ducke), p. 419, and *M. injucundus* (Sauss.), p. 352. It is not clear how these species survive amongst the ants. Ducke (1910 : 458) has suggested that in *Leipomeles* the petiole of the comb is coated with a sticky substance, but we did not observe this in any *Mischocyttarus*. One receives rather the impression that some system of mutual toleration has been developed. This impression is strongest in another Polybiine, *Protopolybia emortualis* (Sauss.), observed by us and by Ducke (1910 : 470) to nest on trees of which the underside of almost every leaf is a carton bag forming part of a multiple ants' nest (*Dolichoderus bidens* L.). The wasp's envelope is almost indistinguishable from one of the cartons and when the tree is disturbed the wasps retire into their nest (!) instead of coming out to attack; the ants, however, swarm out everywhere. Bequaert (1933 : 119) notes a similar relation between *Mischocyttarus collaris* (Ducke) and *Dolichoderus abruptus* (Smith) at Manáos, Brazil.

There are a good many records of parasites of *Mischocyttarus*, but only in a few cases have they been specifically determined. The data may be grouped as follows :—Strepsiptera : only identified species is *Clypoxenos americanus* Brèthes from *M. duckei* (Brèthes) (unrecognisable) (p. 322). Unidentified Strepsiptera from *M. flavitarsis* (Sauss.) (Pierce, 1918 : 490, and see p. 361), *M. angulatus* Rich. var. *columbianus* Rich. (p. 389), *M. alfkenii* (Ducke) var.

bahiae Rich. (p. 399). The last two new records are the only ones seen in the 276 ♂ 1059 ♀ examined in writing the present paper, though Ducke (1910 : 457) gives the impression that they are rather common.

Diptera, Phoridae : *Megaselia scalaris* (Lw.) from *M. basimacula* (Cam.) (p. 395); unidentified Phorids from *M. cassununga* (von Iher.) (p. 378), *M. collaris* (Ducke) var. *parallelogrammus* Zik. (p. 420), *M. labiatus* (Fab.) (p. 326). Diptera, Tachinidae : *M. iheringi* Zik. (p. 442), *M. surinamensis* (Sauss.) (p. 437, family of fly uncertain but puparia parasitised by *Signiphora polistomyiella* Rich. (Chalc., Encyrtidae)). Hymenoptera, Ichneumonidae : *Mesostenus cassunungae* Brauns from *M. cassununga* (von Iher.) (p. 379); *Mesostenus* sp. from *M. metoecus* Rich. (p. 413); genus uncertain but probably *Mesostenus*, *M. confirmatus* Zik. (p. 376), *M. iheringi* Zik. (p. 442), *M. mirificus* Zik. (Zikán, 1935 : 169), *M. surinamensis* (Sauss.) (p. 437), *M. wagneri* (Buyss.) (p. 373).

If my views as to the evolution of S. American Vespidae are correct, it is important to accumulate data on the enemies of the wasps, particularly those which destroy the nests. There is almost no information on this point for *Mischocyttarus*. Zikán (p. 348) has recorded the destruction of nest of *M. metathoracicus* (Sauss.) var. *flavoscutellatus* Zik., probably by a bird, and Fitz-Gerald (p. 437) found *M. surinamensis* (Sauss.) in the stomach of a swift, *Strepnoprocne zonaris albicincta* (Cabanis).

5. Keys to Subgenera, Species-groups and Species.

1. Fore and mid femur (figs. 23–4) with a distinct ventral suture near proximal articulation, cutting off a small ring. Proximal inner articulation of fore coxa not or little reflexed into flange (fig. 12).
   [Large species. Clypeus distinctly longer than broad. Tentorial pits rarely much closer to eyes than to antennal sockets. POL : OOL between $\frac{1}{4}$ and $\frac{1}{2}$. Occiput not margined. Anterior margin of pronotum little raised, not preceded by a furrow, lateral fovea present. Anterior margin of proepisternum little raised. Sculpture of mesopleuron always very weak. Dorsal division of metapleuron acutely produced ventrally. First abdominal tergite with spiracular ratio (fig. 4) between $\frac{1}{2}$ and $\frac{3}{4}$] subg. *Mischocyttarus* Sauss. 2.
–. Fore femur without, mid femur rarely with traces of ventral suture near proximal articulation. Proximal inner articulation of fore coxa reflexed, forming a more or less distinct flange (fig. 56). Species usually smaller 3.
2. First abdominal tergite unusually long and narrow, emargination at end of sternite (fig. 11) twice as wide as deep. Mandibles with proximal half not ventrally sharp-edged. Hind ocelli separated by about their diameter. Pronotal keel rarely distinctly sharp. Malar space half as long as width of antennal socket. Inner lobe of hind tarsal segment 3 either considerably or scarcely longer than outer lobe of 4. Male antennae with segment 13 two and a half times as long as broad, shorter than segments 11–12, segments somewhat flattened and shining beneath. Male mandible with three teeth, sometimes with traces of fourth (dorsal one). Membranous digitus (figs. 14–18) of genitalia short and broad, teeth on aedeagus continued right up to median ventral hook (fig. 13) Group of *M. labiatus* (Fab.), p. 310.
–. First abdominal tergite not very long and narrow, emargination at end of sternite (fig. 25) four times as wide as deep. Mandibles with proximal half ventrally sharp-edged. Hind ocelli separated by less than their diameter. Pronotal keel sharp throughout. Malar space three-quarters as long as width of antennal socket. Inner lobe of hind tarsal

segment 3 a little longer than outer lobe of 4. Male antennae with segment 13 three and a half times as long as broad, little shorter than 11 + 12, segments with broad shining ventral areas. Male mandibles with four teeth. Membranous digitus of genitalia (fig. 26) long and finger-shaped, teeth on aedeagus ending well before median ventral hook
Group of *M. flavicans* (Fab.), p. 311.

3. Pronotum with a lateral fovea (except a few specimens of *M. injucundus* (Sauss.) and *M. tolensis* sp. n. which have occiput margined, clypeus distinctly broader than long, anterior margin of proepisternum strongly reflexed and mesopleuron more or less strongly sculptured). Clypeus as long as broad or broader, usually in contact with eyes for only a short distance, tentorial pits usually about equidistant from eyes and antennal sockets. Spiracular ratio usually about 1 ($\frac{5}{4}$–$\frac{4}{5}$). Male genitalia with digitus long and finger-shaped (fig. 41)
subg. *Kappa* Sauss. 4.

–. Pronotum with no lateral fovea (except a very minute one in *M. foveatus* sp. n., which has tentorial pits much closer to eyes than to antennal sockets, eyes in contact with clypeus for a long distance, clypeus longer than broad, propodeal furrow very weak and hind claws hardly asymmetrical). Clypeus usually longer, sometimes as long as broad, usually in contact with eyes for a long distance, tentorial pits usually considerably closer to eyes than to antennal sockets. Spiracular ratio usually clearly less than 1. Male genitalia with digitus broad, often short. Male antennae always more or less distinctly modified . . . . . 7.

4. Anterior margin of proepisternum (fig. 38) strongly raised and reflexed. Occiput usually margined (fig. 29), at any rate in centre (except *M. immarginatus* Rich. and *M. latior* (Fox)). Keel of pronotum strong but widely interrupted in centre.
(Malar space $\frac{1}{4}$ to $\frac{1}{2}$ as long as width of antennal socket. Clypeus 1–1$\frac{1}{3}$ times as broad as long. POL : OOL = $\frac{1}{2}$–1. Posterior ocelli separated by 2$\frac{1}{2}$ diameters. Anterior margin of pronotum strongly raised, preceded by a furrow whose posterior margin is obtuse or at most a sharp right angle. Dorsal division of metapleuron (fig. 39) usually subacutely produced ventrally, more rarely obtuse. Inner lobe of segment 3 of hind tarsi much longer than outer lobe of segment 4. Central furrow of propodeum usually rather strong. Sculpture of mesopleuron strong, usually with distinct punctures. Colour usually mainly black. Male with three mandibular teeth, antennae with distal segments elongate, most of intermediate segments with shining areas beneath)
Group of *M. ater* (Sauss.), p. 312.

–. Anterior margin of proepisternum little raised or reflexed. Posterior ocelli separated by 2 diameters or less. Occiput not margined (but cf. *M. undulatus* (Ducke), p. 338). Pronotal keel usually much more obtuse. Male (not known in group of *M. heliconius* Rich.) with four mandibular teeth, antennal segments not or very indistinctly shining beneath . . 5.

5. Mesopleuron with no evident sculpture. Dorsal division of metapleuron subacutely produced ventrally. Keel of pronotum rather strong, sharp, somewhat convex anteriorly.
(Malar space about $\frac{1}{3}$ as long as width of antennal socket. Clypeus as long as broad. POL : OOL = $\frac{1}{3}$. Anterior margin of pronotum strongly raised, preceded by a slight furrow whose posterior margin is obtuse. Inner lobe of segment 3 of hind tarsi much longer than outer lobe of segment 4. Central furrow of propodeum not very strong. Male unknown) . . . . . Group of *M. heliconius* Rich., p. 311.

–. Mesopleuron with conspicuous granulate or punctate sculpture. Dorsal division of metapleuron obtuse ventrally. Keel of pronotum rarely so strong or sharp, usually straight . . . . . 6.

6. Segment 3 of mid tarsi little asymmetrical (fig. 57). Inner lobe of segment 3 of hind tarsi little longer than outer lobe of segment 4. Male antennae with at least segment 13 very elongate.
   (Malar space often half as long as width of antennal socket or longer. Clypeus broader than long. Furrow preceding anterior margin of pronotum with its posterior margin obtuse. Central furrow of propodeum often strong. Male of *M. pallidipectus* (Smith) often has one spur of mid tibia reduced or absent)
   Group of *M. flavitarsis* (Sauss.), p. 313.
–. Segment 3 of mid tarsi strongly asymmetrical (fig. 68). Inner lobe of segment 3 of hind tarsi much longer than outer lobe of segment 4. Male antennae with segment 13 hardly longer than 12.
   (Malar space not more than one-third as long as width of antennal socket. Clypeus about as long as broad. Furrow preceding anterior margin of pronotum with its posterior margin sometimes laminate. Central furrow of propodeum weak) . . . Group of *M. cubensis* (Sauss.), p. 316.
7. Keel of pronotum very strong, lobate at sides, anteriorly strongly concave. Occiput strongly margined throughout. Considerable areas on thorax with large separate punctures. POL : OOL = 1–2. Hind ocelli separated by $1\frac{2}{3}$–$3\frac{1}{2}$ diameters.
   (Malar space extremely short. Clypeus considerably longer than broad. Anterior margin of pronotum strongly raised, preceded by a furrow whose posterior margin may be subacute but is not laminate. Dorsal division of metapleura obtuse below. Hind tarsus with inner lobe segment 3 little longer than outer lobe of segment 4. Mid tibiae often with only one spur. Male not seen) . . . . subg. *Omega* Sauss., p. 318.
–. Keel of pronotum very rarely so strong and at the same time anteriorly strongly concave; if approaching this condition, then occiput not margined. Thorax never with large punctures. POL : OOL at most = 2 : 3. Propodeal furrow always very weak. Mid tibiae always with two spurs. Male antennal segments with no distinct shining areas beneath . . . . . 8.
8. Segment 3 of mid tarsi almost symmetrical. Inner lobe of segment 3 of hind tarsi not longer than outer lobe of segment 4, claws hardly asymmetrical.
   [Malar space at most one-quarter as long as width of antennal socket. Occiput not margined. POL : OOL = $\frac{1}{3}$–$\frac{1}{2}$. Posterior ocelli separated by less than their diameter. Anterior margin of pronotum little raised, not preceded by a furrow, fovea absent or (one species) minute, keel weak, gradually evanescent at sides, straight or anteriorly a little convex. Anterior margin of proepisternum little raised or reflexed. Dorsal division of metapleuron acutely or more or less obtusely produced below. Mesopleuron very finely sculptured, more or less shining. Male mandible with four teeth. Male antenna with segments 10–13 elongate, subspirally rolled. Male aedeagus (fig. 74) unusually broad, ventral teeth very long, ventral hook very long, acute, directed laterally at right angles to long axis
   subg. *Monogynoecus* Rich. Only group of *M. lecointei* (Ducke), p. 319.
–. Segment 3 of mid tarsi distinctly asymmetrical. Inner lobe of segment 3 of hind tarsi much longer than outer lobe of segment 4, claws strongly asymmetrical. Pronotum never with fovea. Male mandible with three teeth. Male aedeagus of normal narrow type with small ventral teeth and ventral hook shorter, blunter and directed antero-ventrally along axis . . . . . subg. *Megacanthopus* Ducke. 9.
9. Anterior margin of pronotum (fig. 76) very strongly raised and reflexed, ending in a hook ventrally, preceded by a broad furrow in which there are three large hyaline depressions.

(Malar space one-quarter as long as width of antennal socket. Clypeus as broad as long. POL : OOL = $\frac{1}{2}$. Hind ocelli separated by $1\frac{1}{2}$–2 diameters (♀) or $1\frac{1}{4}$–$1\frac{1}{2}$ diameters (♂). Occiput not margined. Pronotal keel very strong, anteriorly convex. Anterior margin of proepisternum considerably raised and reflexed. Dorsal division of metapleuron acutely produced below. Mesopleuron more or less granulate, rarely a little shining. Male antenna with segments 10–13 elongate, subspirally rolled, 13 flattened and truncate). . Group of *M. collaris* (Ducke), p. 319.

–. Anterior margin of pronotum less strongly raised and reflexed, not ending in a hook ventrally, without depressions in the furrow. Posterior ocelli separated by rather more or less than one diameter. Male antennae with segments 10–13 elongate, subspirally rolled, 13 cylindrical, not truncate . . . . . 10.

10. Anterior margin of pronotum more or less strongly raised, preceded by no furrow or by a weak furrow whose posterior margin is obtuse.
(Malar space one-quarter as long as width of antennal socket. Clypeus somewhat longer than broad. POL : OOL = $\frac{1}{2}$–$\frac{2}{3}$. Pronotal keel more or less strong, straight) . . . . . 11.

—. Anterior margin of pronotum strongly raised, preceded by a furrow whose posterior margin is acute, usually laminately produced.
(Sculpture of mesopleuron usually very fine. Clypeus about as long as broad. Occiput not margined in centre. Pronotal keel straight or more or less concave anteriorly) . . . . . 12.

11. Central part of occiput margined. Mesopleuron with hardly visible sculpture.
(Proepisternum with anterior margin reflexed or not. Dorsal division of metapleuron ventrally obtusely or subacutely produced)
Group of *M. prominulus* Rich., p. 320.

—. Occiput not margined. Mesopleuron with rather strong granulate sculpture.
(Proepisternum with anterior margin rather strongly raised and reflexed. Dorsal division of metapleuron ventrally obtuse)
Group of *M. surinamensis* (Sauss.), p. 320.

12. Occiput quite strongly margined at sides though not in centre. Mesopleuron moderately granulate.
(Larger claw of hind tarsi considerably larger and blunter than smaller one. Posterior ocelli separated by one and a half diameters. Pronotal keel with lateral extremities somewhat reflexed. POL : OOL = $\frac{1}{3}$–$\frac{1}{2}$. Anterior margin of proepisternum narrowly reflexed. Dorsal division of metapleuron ventrally acutely produced. Ocellar region almost entirely black) . . . . . Group of *M. iheringi* Zikán, p. 440.

—. Occiput nowhere margined. Mesopleuron almost quite smooth . . . 13.

13. Larger claw (fig. 103) of hind tarsi somewhat longer but not much blunter than smaller one. Posterior ocelli separated by one and a half diameters. Pronotal keel with lateral extremities somewhat lobate and bent posteriorly.
(POL : OOL = $\frac{1}{2}$–$\frac{2}{3}$. Anterior margin of proepisternum rather strongly raised and reflexed. Dorsal division of metapleuron subacutely produced ventrally. Dark mark surrounding ocelli without lateral " wings.")
Group of *M. cerberus* Ducke, p. 321.

—. Larger claw (fig. 118) of hind tarsi much larger, blunter and more truncate than smaller one. Posterior ocelli separated by a little more or less than one diameter. Pronotal keel with lateral extremities not lobate.
(POL : OOL = $\frac{1}{3}$–$\frac{1}{2}$. Anterior margin of proepisternum moderately raised, little reflexed. Dorsal division of metapleuron ventrally obtusely or acutely produced. Dark mark surrounding ocelli usually with lateral " wings," fig. 108) . . . . Group of *M. artifex* Ducke, p. 321.

Group of *M. labiatus* Sauss.

1. Abdominal tergite 1 (fig. 6) shorter and wider than in other species, spiracles not at all projecting, its pubescence very short and almost entirely recumbent. ♂ antenna with segments 5–12 about quadrate, 13 hardly twice as long as broad (Pronotal keel weak or at least centrally interrupted. ♀ clypeus rather bluntly rounded. Hind tarsus with inner lobe of segment 3 not at all longer than outer lobe of segment 4 in either sex. Petiole reddish, nearly always considerably paler than rest of abdomen) . . . . . *M. drewseni* Sauss., p. 328. 2.
–. Abdominal tergite 1 longer and narrower, with spiracles more or less distinctly projecting and (except *M. smithii* Sauss.) at least with some outstanding pubescence. ♂ antenna with segments 5–12 longer than broad, 13 about two and a half times as long as broad . . . . 3.
2. Size large, wing-length, ♀, 15·5–17·0 mm., ♂, 13·5–16·0 mm. Thorax unusually dark, only part round propodeal orifice reddish. Pubescence of mesosternum silvery and conspicuous. Pronotal keel as in var. *drewseni* Sauss. Argentina: Jujuy . . . . var. *gigas* var. n., p. 330.
–. Size smaller, wing-length, ♀, 11·0–15·5 mm., ♂, 11·0–15·0 mm. Thorax and propodeum usually partly reddish-tinged, especially postero-ventrally. Pubescence less conspicuous. Pronotum usually blackish, keel not strong, even at sides. S. America . var. *drewseni* Sauss., p. 328.
–. Characters of var. *drewseni* Sauss. (wing-length, ♀, 14·0, 17·5 mm., ♂, 12·0. 12·5 mm.). Pronotum considerably reddish, keel quite strong at sides. Bolivia and British Guiana . . var. *steinbachi* var. n., p. 329.
3. Spiracles of abdominal tergite 1 very strongly projecting, its pubescence short and appressed. (Black species with dark violet-tinged wings, 15·5–20·0 mm. long. Abdominal tergite 1 (fig. 5) relatively short. Pronotal keel continuous but not very strong. Hind tarsus with inner lobe of segment 3 considerably longer than outer lobe of segment 4 in both sexes. Brit. Guiana and Brazil) . . . . *M. smithii* Sauss., p. 327.
–. Spiracles of abdominal tergite 1 less strongly projecting, pubescence beneath it partly outstanding . . . . . 4.
4. Pronotal keel continuous, more or less strong and sharp. Hind tarsus with inner lobe of segment 3 considerably longer than outer lobe of segment 4 (except *M. lindigi* sp. n. and *M. gynandromorphus* sp. n.) . . . . 5.
–. Pronotal keel weak and centrally interrupted . . . . . 8.
5. Keel of pronotum very strong and sharp, especially in centre. (Wings usually pale. Wing-length and hamuli, ♀, 17·0–19·0 mm., 14–19; ♂, 14·0–16·0 mm., 13–16. Abdominal tergite 1 as in *M. labiatus* (Fab.) but pubescence more abundant. Peru, Brazil)
M. tomentosus Zikán, p. 327.
–. Keel of pronotum less strong, not stronger in centre. Wings usually dark 6.
6. Abdominal tergite 1 rather short and narrow (about as in *M. rotundicollis* (Cam.)) with abundant, long, outstanding pubescence. Ventral margin of ♀ clypeus bluntly rounded (fig. 3), more obtuse than in any other species of the group except some extreme forms of *M. drewseni* Sauss. Hind tarsus with inner lobe of segment 3 not longer than outer lobe of segment 4. (Wing-length and hamuli, ♀, 15·5–18·0 mm., 14–16; ♂, 15·0, 16·0 mm., 13, 15. Peru, Matto Grosso)
M. gynandromorphus sp. n., p. 332.
–. Abdominal tergite 1 with shorter, less abundant pubescence. Ventral margin of ♀ clypeus (figs. 1–2) strongly, subangularly produced . . . 7.
7. Abdominal tergite 1 (fig. 7) a little shorter (as in *M. rotundicollis* (Cam.)) though outstanding pubescence is very sparse. Colour black and shining, especially on abdomen. Hind tarsus with inner lobe of seg-

ment 3 hardly longer than outer lobe of segment 4. (♂ unknown; ♀ (one spec.), wing-length and hamuli, 15·0 mm., 21. Colombia)
M. lindigi sp. n., p. 332.

–. Abdominal tergite 1 (fig. 4) very long and narrow, nearly always with quite distinct outstanding pubescence. Colour dark brown, dull owing to dense microscopic pubescence. Hind tarsus with inner lobe of segment 3 longer than outer lobe of segment 4. (Wing-length and hamuli, ♀, 14·5–20·0 mm., 13–21 (in 43/54 spec. less than 19); ♂, 13·0–19·0 mm., 11–19 (in 35/40 spec. less than 18). Panama to Amazons and Bolivia)
M. labiatus (Fab.), p. 325.

8. Large species, wing-length 14·0–19·0 mm., with abdominal tergite 1 as in *M. labiatus* (Fab.) but with outstanding pubescence shorter and sparser. Abdomen usually more shining, owing to wider spacing of microscopic pubescence. Hind tarsus with inner lobe of segment 3 considerably longer than outer lobe of segment 4. (Hamuli, ♀, 16–25 (in 9/33 spec. less than 19); ♂, 14–22 (in 7/20 spec. less than 18). Mexico to Colombia)
M. melanarius (Cam.), p. 322.

–. Smaller species, wing-length 11·5–16·5 mm., with abdominal tergite 1 relatively shorter, with more distinct outstanding pubescence. Hind tarsus with inner lobe of segment 3 not in ♀ or little in ♂ longer than outer lobe of segment 4. (Hamuli, ♀, 13–20; ♂, 11–16. S. America.
M. rotundicollis (Cam.), p. 330.

Key to the species of the groups of *M. flavicans* (Fab.) and *M. heliconius* Rich.

1. Malar space about one-third as long as width of antennal socket. Clypeus as long as broad. Abdominal tergite 1 narrower anteriorly. Inner lobe of segment 3 of hind tarsus strongly produced . . . . . 2.

–. Malar space at least three-quarters as long as width of antennal socket. Clypeus longer than broad. Abdominal tergite 1 broader anteriorly. Inner lobe of segment 3 of hind tarsus little produced . . . . . 4.

2. Granular sculpture of propodeum considerably stronger, keel in central furrow more distinct. Tergite 1 broader anteriorly and less broad posteriorly. Clypeus (fig. 28) a little less angularly produced. Insect entirely black . . . . . *M. piger* sp. n., p. 340.

–. Granular sculpture of propodeum weaker. Tergite 1 narrower anteriorly, more expanded posteriorly. Ventral margin of clypeus (fig. 27) more angular. Insect brownish or yellow . . *M. heliconius* sp. n., p. 338. 3.

3. Mainly brownish-black, with feeble yellow marks, clypeus yellow. Abdominal tergites 3–6 black . . . . . var. *heliconius* var. n., p. 339.

–. Mainly testaceous, with black marks on dorsal aspect of head and thorax. Abdomen brownish with posterior yellow bands on each segment
var. *iperuae* var. n., p. 340.

4. Insect mainly testaceous . . . . . *M. flavicans* (Fab.), p. 333. 5.

–. Insect black with scutellum, postscutellum and propodeum extensively yellow marked. Mesopleuron more shining. Abdomen shining
M. duckei (du Buysson), p. 337.

–. Insect almost entirely black. Ventral margin of clypeus (fig. 22) more truncate than in *M. flavicans* (Fab.), teeth of weak bidentation farther apart . . . . . *M. carbonarius* (Sauss.), p. 336.

5. Abdomen shining, tergites 3–6 (except narrow yellow posterior margin of 3) and sternites 3–6 black. Clypeus (fig. 20) with ventral margin almost pointed, narrowly bidentate . . . . . var. *flavicans* (Fab.), p. 335.

–. Abdomen dull, tergites 3 4 with posterior yellow bands, 5–6 and all sternites testaceous. Clypeus (fig. 21) distinctly pointed, not bidentate
var. *coroico* var. n., p. 335.

Key to the species of the group of *M. ater* (Oliv.).

1. Abdominal tergite 1 (figs. 36–7) much shorter than hind femur (hardly longer than hind coxa + trochanter), dorsally very convex. Segment 5 of front tarsus black above. (Propodeal furrow deep, not broadened below, almost reaching postscutellum, no horizontal dorsal area on propodeum. Black species, wings black, usually with white tip. C. and S. America) . . . . . *M. ater* (Oliv.), p. 352.

–. Abdominal tergite 1 (fig. 32) distinctly shorter than hind femur, dorsally only feebly convex. Segment 5 of front tarsus yellow above. (Propodeum similar, but furrow somewhat broader and weaker. Black species, head largely reddish, wings nearly hyaline) *M. frontalis* (Fox), p. 344. 2.

–. Abdominal tergite 1 little or not shorter than hind femur, dorsally only feebly convex. Segment 5 of hind tarsus pale above . . . . . 3.

2. Outer orbits, pronotal keel and posterior margin, anterior half of postscutellum, posterior margin of tergite 1, yellow (Brazil) var. *frontalis* (Fox), p. 345.

–. These parts black or somewhat ferruginous-tinged; only extreme lateral extremities of pronotal keel yellow (S. Brazil) var. *anthracinus* var. n., p. 345.

3. Abdominal tergite 1 (fig. 34) almost the same width throughout, considerably longer than hind femur + trochanter, spiracles distinctly projecting. Propodeum with very large, honeycomb-like punctures. (Propodeum with small dorsal horizontal area, furrow separated by half its length from postscutellum. Pará) . . . . *M. tapuya* (Schulz), p. 348.

–. Abdominal tergite 1 distinctly expanded posteriorly, usually about as long as hind femur, spiracles less projecting. Punctures of propodeum less large . . . . . 4.

4. Central furrow of propodeum separated by not more than one-fifth its length from postscutellum, surface of propodeum closely and uniformly punctured. (POL : OOL = 1 : 2. Malar space one-third as long as width of antennal socket. Amazons) . *M. pseudomimeticus* (Schulz), p. 348.

–. Central furrow of propodeum separated by at least one-third its length from postscutellum. (POL : OOL = 2 : 3) . . . . . 5.

5. Malar space half as long as width of antennal socket. Abdomen with rather long silky pubescence. (Occiput not margined. Propodeum with close punctures all of one size, furrow separated by one-third its length from postscutellum, anterior horizontal area small. S. America) *M. latior* (Fox), p. 344.

– . Malar space not more than one-quarter as long as width of antennal socket. Abdomen with shorter, less conspicuous pubescence . . . 6.

6. Occiput without faintest trace of keel. Structure of propodeum intermediate between the two types of couplet 7. Abdominal tergite 1 as long as hind femur (Northern C. America) *M. immarginatus* Rich., p. 355.

–. Occiput with a distinct marginal keel. . . . . 7.

7. Anterior horizontal area of propodeum quite distinct, central furrow not well defined, becoming very broad and ill defined below . . . . . 8.

–. Anterior horizontal area of propodeum not well developed or absent; central furrow deep, clearly defined, not less so below. (Abdominal tergite 1 (fig. 33) as long as or a little shorter than hind femur) . . . 15.

8. Central furrow of propodeum separated by half its length from postscutellum, very shallow and ill defined, anterior horizontal area very distinct, surface with punctures separated by 1–3 diameters (some larger punctures interspersed laterally). Abdominal tergite 1 a little longer than hind femur . . . . . *M. metathoracicus* (Sauss.), p. 346. 9.

–. Central furrow of propodeum separated by one-third its length from postscutellum, a little deeper, anterior horizontal area less distinct, surface with punctures separated by ½–1 diameter. Abdominal tergite 1 (fig. 35) distinctly longer than hind femur
M. injucundus (Sauss.), p. 349. 13.

9. Head, pronotum and metapleuron ferruginous. (Scutellum black. Propodeum with two yellow stripes, furrow black. Matto Grosso)
var. *picturatus* Beq., p. 347.

–. Head, pronotum and metapleuron with very slight ferruginous markings 10.

10. Scutellum black or with its anterior half black. (Propodeum usually black or with its dorsal half black. British Guiana) . . . var. 2, p. 346.

—. Scutellum yellow . . . . . 11.

11. Propodeum black. (Abdominal tergite 1 rather short and broad. Coxae almost entirely black. E. Bolivia) . . . . . var. 3, p. 347.

—. Propodeum yellow-marked . . . . . 12.

12. Propodeum dorsally with a small transverse yellow spot which emits a narrow stripe posteriorly. Markings more orange (Rio de Janeiro)
var. *flavoscutellatus* Zikán, p. 347.

—. Propodeum entirely yellow or with quadrate yellow dorsal spot which may or may not emit a narrow posterior stripe (Amazons)
var. *metathoracicus* (Sauss.), p. 346.

13. Anterior third of postscutellum and two rounded spots (sometimes nearly absent) on propodeum yellow . . . . . 14.

—. Whole of postscutellum, two spots extending across or nearly across the propodeum yellow. (Mid and hind tibiae distally yellow. Wings nearly hyaline. Paraguay) . . . . . var. *bertonii* Ducke, p. 351.

14. Yellow propodeal spots usually large. Mid and hind tibiae distinctly yellow-marked distally. Wings nearly hyaline (Brazil)
var. *injucundus* (Sauss.), p. 350.

—. Yellow propodeal spots small or absent. Mid and hind tibiae not or hardly yellow marked distally. Wings strongly yellow-tinged, distally fuscous (Guiana) . . . . . var. *bimarginatus* (Cam.), p. 351.

15. Propodeum with distinct larger punctures interspersed amongst fine ones which are considerably finer than those of mesonotum; dorsal horizontal area not developed. Abdominal tergite 1 (fig. 30) a little shorter and broader (Panama) . . . . . *M. tolensis* Rich., p. 341.

—. Propodeum with uniform punctures about the same size as those of the mesonotum; dorsal horizontal area distinct, though small. Abdominal tergite 1 (fig. 31) a little longer and narrower (Trinidad)
M. fitzgeraldi Beq., p. 342.

Key to the species of the group of *M. flavitarsis* (Sauss.). For key to known males see also p. 316.

1. Malar space at least half as long as width of antennal socket. Furrow preceding anterior margin of pronotum with its posterior edge quite obtuse . . . . . 2.

–. Malar space about one-quarter as long as width of antennal socket. Pronotum with anterior margin moderately raised, preceded by a furrow whose posterior margin is obtuse, keel uninterrupted but obtuse throughout. (Black and brown species, with almost no yellow markings, pubescence long. Propodeal furrow deep and well defined, separated by rather less than half its length from postscutellum. Abdominal tergite 1 somewhat longer than hind femur, little expanded distally. Peru) . . . . . *M. commixtus* sp. n., p. 371.

–. Malar space about one-quarter as long as width of antennal socket or less. Pronotum with the anterior margin well raised, preceded by a deep

furrow whose posterior margin is sharp; keel more or less sharp on lateral quarters . . . . . 15.

2. Pronotal keel entirely obtuse or only sharp-edged at extreme sides (lateral eighths) . . . . . 3.

–. Pronotal keel sharp-edged on each lateral quarter or more . . . . . 11.

3. Pronotal keel sharp-edged at extreme sides (lateral eighths); abdominal tergite 1 shorter than hind femur. (Malar space half as long as width of antennal socket. Clypeus a little broader than long, ventral margin angular. POL : OOL = $\frac{1}{2}$ or a little more. Propodeal furrow deep, well defined. Species largely blackish, only legs considerably yellow-marked. S. Brazil) . . . . . *M. extinctus* Zikán, p. 366.

–. Pronotal keel entirely obtuse or obsolete. Abdominal tergite 1 about as long as hind femur or longer . . . . . 4.

4. Malar space nearly as long as width of antennal socket. POL : OOL = $\frac{1}{3}$. Clypeus (fig. 47) one and a half times as broad as long, ventral margin rounded. (Propodeal furrow shallow, ill defined. Cuba) *M. bruneri* Beq. and Salt, p. 367.

–. Malar space a little more than half as long as width of antennal socket. POL : OOL = $\frac{2}{5}$–$\frac{1}{2}$. Clypeus (fig. 48) a little broader than long . . 5.

5. Abdominal tergite 1 much longer and narrower, longer than hind femur + trochanter. Propodeal furrow broad, shallow, ill defined. (Ventral margin of clypeus angular. Black species with yellowish legs and yellow-brown wings; pubescence of thorax long, none of it appressed. Mt. Duida, Venezuela) . . . . . *M. duidensis* sp. n., p. 370.

–. Abdominal tergite 1 hardly longer than hind femur. Propodeal furrow deep and well defined . . . . . 6.

6. Ventral margin of clypeus rounded (figs. 43–4). Larger species, more extensively yellow-marked, with yellow-brown wings, 11·5–15·5 mm. long (N.W. Mexico to W. Canada) . . *M. flavitarsis* (Sauss.), p. 357. 7.

–. Ventral margin of clypeus (figs. 45–6) angular. Smaller, black species, with rather reduced, pale yellow markings, with pale fuscous wings, 8·5–11·5 mm. long. (Mexico: Guerrero and Vera Cruz, to Rep. Honduras) . . . . . *M. pallidipectus* (Smith), p. 361.

7. Wings strongly infuscate [7] . . . . . 8.

–. Wings yellow-brown . . . . . 9.

8. Thorax black, without or with few ferruginous blotches and with reduced yellow markings. Abdominal tergite 1 as a rule black or slightly brownish (rarely ferruginous), broadly yellow posteriorly; rest of abdomen mainly yellow (S. Arizona). . . . . var. *navajo* Beq., p. 360.

–. Ground-colour ferruginous with mere traces of black. Yellow markings of thorax reduced. Yellow bands of abdominal segments reduced, mostly replaced by ferruginous (N. Arizona) . . var. *kaibabensis* Beq., p. 361.

9. Black parts of body considerably invaded by ferruginous, at least on abdominal tergite 1 (S. Utah and Colorado to New Mexico) var. *centralis* Beq., p. 360.

–. Hardly any traces of ferruginous colour present; at most faint traces of it where the yellow and black meet on abdominal tergites 1–2 . . . 10.

10. Yellow markings more extensive; top of prepectus, mid and hind tarsi dorsally usually yellow-marked; abdominal tergites 2–6 mainly yellow (Oregon, California, Utah, Colorado, Nebraska) var. *flavitarsis* (Sauss.), p. 359.

—. Yellow markings reduced; top of prepectus and mid and hind coxae usually black; abdomen usually with only two rather narrow segmental bands (Utah, Oregon, Montana, Idaho, Washington, Brit. Columbia, Alberta and Hawaiian Is.) . . . . . var. *idahoensis* Beq., p. 360.

Variation of *M. flavitarsis* (Sauss.) after Bequaert (1933).

11. Large species, wing-length 12·5 mm. Dark, with mesonotum ferruginous. Clypeus very distinctly broader than long, ventral margin rounded. Malar space as long as width of antennal socket. (Propodeal furrow shallow and ill defined. Paraguay) . . . *M. marginatus* (Fox), p. 369.
—. Large species, wing-length 13·0 mm. Ferruginous with yellow and (few) black markings. Clypeus as long as broad. Malar space two-thirds as long as width of antennal socket. (Propodeal furrow moderately deep and well defined. Brazil: Matto Grosso) *M. chapadae* (Fox), p. 369.
—. Smaller, wing-length 10·0–12·0 mm., mainly black species (or abdomen ferruginous but mesonotum always black). Malar space hardly more than half as long as width of antennal socket . . . . . 12.
12. Propodeal furrow shallow, ill defined, separated by two-thirds of its length from postscutellum. Head, thorax and abdominal tergite 1 with quite abundant outstanding pubescence (Peru, Colombia, Ecuador) *M. hirsutus* sp. n., p. 363. 13.
—. Propodeal furrow deep, well defined, separated by one-quarter its length from postscutellum. Head, thorax and abdominal tergite 1 with little or no outstanding pubescence (S. Brazil) . . . *M. pallidipes* sp. n., p. 366.
13. Abdomen largely ferruginous with narrow yellow bands (Ecuador) var. *rufomaculatus* var. n., p. 364.
—. Abdomen mainly black . . . . . 14.
14. Abdominal tergites 1–2 or 1–3 with narrow yellow bands. Legs mainly black. Female mesosternum black (Ecuador, Colombia) var. *hirsutus* var. n., p. 364.
—. Abdominal tergites black, at most some ferruginous at sides of 2. Legs mainly yellow. Female mesosternum with two yellow marks (Peru) var. *tarmensis* var. n., p. 365.
15. Abdominal tergite 1 as long as hind femur + trochanter. Propodeal furrow shallow and ill defined . . . . . 16.
—. Abdominal tergite 1 as long as hind femur. Propodeal furrow deeper and better defined . . . . . 18.
16. Abdominal tergite 1 (fig. 50) a little longer and narrower. Punctures generally finer, pubescence shorter and denser (S.E. Brazil) *M. wagneri* (du Buyss.), p. 371.
—. Abdominal tergite 1 (fig. 51) a little shorter and broader. Punctures coarser, pubescence longer, and, though sparser, more conspicuous on the petiole (Colombia) . . . . . *M. barbatus* sp. n., p. 373. 17.
17. Abdominal tergite 1 a little longer . . . . var. *barbatus* var. n., p. 374.
—. Abdominal tergite 1 a little shorter . . . var. *cisandinus* var. n., p. 374.
18. Pronotal keel not at all reflexed laterally. Abdominal tergite 1 less expanded . . . . . 19.
—. Pronotal keel a little reflexed laterally. Abdominal tergite 1 (fig. 54) more expended, expansion beginning a little before the spiracles (S.E. Brazil) . . . . . *M. cassununga* (R. von Iher.), p. 376.
19. Abdominal tergite 1 (fig. 55) wider anteriorly, more gradually widened posteriorly. Central furrow of propodeum weaker. Yellow and black species (Paraguay) . . . . . *M. paraguayensis* Zikán, p. 379.
—. Abdominal tergite 1 (fig. 53) narrower anteriorly, more abruptly widened posteriorly. Central furrow of propodeum stronger. Black species with relatively small yellow markings . *M. confirmatus* Zikán, p. 375. 20.
20. Abdominal tergites 1–2 with yellow bands; propodeum apparently with no conspicuous yellow marks (Brazil: Rio de Janeiro) var. *confirmatus* Zikán, p. 376.
—. Abdominal tergites 1–5 with yellow bands, propodeum with large yellow spots (Brazil: Ceará) . . . . . var. *cearensis* var. n., p. 375.

Group of *M. flavitarsis* (Sauss.). Key to the known males.

1. Malar space at least half as long as width of antennal socket. Furrow preceding anterior margin of pronotum with its posterior edge quite obtuse . . . . . 2.
–. Malar space less than one-quarter as long as width of antennal socket. Furrow preceding anterior margin of pronotum with its posterior edge acute. Mid tibial spurs of equal length. Antenna with segment 9 quadrate or just transverse, 12 as long as 9 (shorter than 6)
M. barbatus sp. n., *M. cassununga* (R. von Iher.), *M. extinctus* Zikán, *M. paraguayensis* Zikán. (Separated in the same way as their females.)
2. Pronotal keel entirely obtuse. Antennal segment 9 nearly twice as long as broad, 12 as long as 6 . . . . . 3.
–. Pronotal keel with about one-third of its width on each side acute. Mid tibia with spurs of equal length. Antennal segment 9 hardly longer than broad, 12 as long as 9 (shorter than 6) . . . . . 4.
3. Malar space as long as width of antennal socket. Mid tibia with spurs of about equal length . . . . . *M. flavitarsis* (Sauss.), p. 357.
–. Malar space hardly more than half as long as width of antennal socket. Mid tibia with one spur not more than one-third the length of the other, usually absent . . . . . *M. pallidipectus* (Smith), p. 361.
4. Malar space as long as width of antennal socket. Mesonotum ferruginous *M. marginatus* (Fox), p. 369.
–. Malar space half as long as width of antennal socket. Mesonotum black *M. hirsutus* sp. n., p. 363.

Key to the species of the group of *M. cubensis* (Sauss.).

1. Claws of hind tarsi very little asymmetrical. Posterior margin of furrow preceding anterior margin of pronotum right-angled or acute and weakly lamellate. Moderate-sized species, chiefly red-brown in colour, with not very extensive yellow marks. (Haiti, Porto Rico, Virgin Is., St. Lucia and, apparently, Colombia) . . . . . *M. phthisicus* (Fab.), p. 400.
–. Claws of hind tarsi more or less strongly asymmetrical, the outer one longer, wider and blunter . . . . . 2.
2. Posterior margin of furrow preceding anterior margin of pronotum obtuse, rarely a little acute. In yellower forms, anterior margin of posterior scutellar black mark straight . . . . . 3.
–. Posterior margin of furrow preceding anterior margin of pronotum acute, more or less lamellate. Scutellum either with posterior black mark very reduced or with its anterior margin nearly always angular. When the abdomen has dark bands, their posterior margins straight or little curved. Mesonotum with yellow side-stripes . . . . . 10.
3. Abdominal tergite 1 (fig. 64) rather short, more expanded distally. Pronotal keel moderately strong. Size usually small, length (H. + Th.+ T1 + T2) 8·0–9·0 mm. Sulphur-yellow species with black markings; mesonotum with yellow side-stripes; abdominal tergites with posterior margins of black bands straight or little curved, or that of tergite 2 bi-emarginate, sternite 1 proximally black (Costa Rica, Guatemala) *M. costaricensis* sp. n., p. 390.
–. Abdominal tergite 1 (fig. 63) longer, anteriorly parallel-sided, posteriorly less expanded. Pronotal keel either stronger or weaker. Size larger, length (H. + Th. + T1 + T2) 8·0–12·0 mm. Markings different . . 4.
4. Pronotal keel stronger, especially at sides. Centre of frontal area largely yellow, except in some specimens of var. *colombianus*. Ventral surface always largely yellow. Mesonotum without yellow side-stripes. Black

bands of abdominal tergites much sinuate laterally or abdomen dorsally yellow-brown (Costa Rica, Rep. Honduras, Panama, Colombia, Bolivia, Martinique and (?) Cayenne) . . . . *M. angulatus* sp. n., p. 386. 5.

–. Pronotal keel weaker, obtuse throughout. Centre of frontal area almost entirely black or ferruginous. Ventral surface black or brown in most varieties (S.E.U.S.A., Antilles, and Mexico to Costa Rica) *M. cubensis* (Sauss.), p. 381. 7.

5. Abdomen yellow with sharp black markings . . . . . 6.

–. Abdomen yellow-brown with indistinct yellow bands on tergites 1–3 (Costa Rica, Rep. Honduras) . . . . . var. *ictericus* var. n., p. 389.

6. Propodeum with antero-lateral triangles not or hardly fused with lateral stripes. Black mesosternal spot nearly always separated from ventral black mark on prepectus. Metasternum with at most anterior half black. Sternite 1 yellow (Costa Rica, Rep. Honduras, Panama, Martinique) . . . . . var. *angulatus* var. n., p. 387.

–. Propodeum with antero-lateral triangles nearly always broadly joined to lateral stripes. Black mesosternal spot joined to or narrowly separated from ventral black mark on prepectus. Metasternum entirely black. Sternite 1 mainly black (Colombia to Bolivia and (?) Cayenne) var. *colombianus* var. n., p. 388.

7. Underside of head and sides and ventral surface of thorax largely yellow 8.

–. Sides and ventral surface of thorax largely black or brown. (♂ may have large yellow spots on mesosternum) . . . . . 9.

8. Head and thorax (except vertex and mesonotum) almost entirely yellow. Abdomen yellow-brown (Honduras) var. *flavissimus* var. n., p. 386.

–. Abdomen dark brown, tergites 1–2 sometimes with narrow posterior bands; sternites mainly yellow. Thorax with more extensive black marks (Mexico, Costa Rica) . . . . . var. *sternalis* var. n., p. 385.

9. Mid tibia with distal third, hind tibia with distal two-thirds black. Thorax mainly black with yellow markings. Underside of head dark ferruginous. Wings considerably yellow-brown. Abdomen dark ferruginous and yellow (Bahamas) . . . . . var. *maculipes* var. n., p. 383.

–. Mid and hind tibia more or less dark ferruginous but not yellow and black contrasting. Thorax mainly black with yellow markings. Underside of head black. Wings nearly hyaline. Abdomen black and yellow (Mexico) . . . . . var. *mexicanus* (Sauss.), p. 384.

–. Mid tibia entirely yellow, hind tibia with an ill-defined distal brown mark. Thorax often largely ferruginous with yellow markings. Underside of head pale ferruginous. Wings considerably yellow-brown tinged. Abdomen ferruginous and yellow (U.S.A.: Florida and Georgia, Cuba) var. *cubensis* (Sauss.), p. 383.

10. On the average smaller, with abdominal tergite 1 (fig. 65) shorter, more broadened posteriorly (Mexico to Peru and S.W. Brazil) *M. basimacula* (Cam.), p. 391. 11.

—. On the average larger, with abdominal tergite 1 (fig. 66) longer, more regularly divergent, less broadened posteriorly. Colour more orange-yellow with the black markings often tinged with brown (Colombia to S.E. Brazil and Paraguay) . . . . *M. alfkenii* (Ducke), p. 395. 14.

11. Length of fore-wing usually 10·5 mm. or more. Antennal segment 3 dorsally orange. Metasternum yellow. Abdomen red-brown, tergites with not very conspicuous posterior yellow bands, sternite 2 yellow (Peru, S.W. Brazil) . . . . . var. *flavicornis* Zikán, p. 394.

—. Length of fore-wing usually 10·0 mm. or less. Antennal segment 3 mainly black above. Abdomen black and sulphur yellow, sternite 2 nearly always black-marked . . . . . 12.

12. Sternite 1 yellow. (Less black-marked; supraclypeal plate usually with only dorsal black line; ventral half of prepectus yellow; metasternum with at most a minute anterior black mark. Mexico to Panama) var. *basimacula* (Cam.), p. 391.
—. Sternite 1 mainly black . . . . . 13.
13. Supraclypeal plate mainly yellow; prepectus ventrally at most with small black spot; metasternum with minute anterior black mark (Guatemala, Costa Rica, Rep. Honduras) . . . . var. *guatemalensis* var. n., p. 393.
—. Supraclypeal plate usually almost entirely black; ventral half of prepectus black; metasternum with at least anterior half black (S.E. Colombia) var. *superpictus* var. n., p. 393.
14. Antenna entirely orange dorsally. Propodeum with rather broad central stripe and black antero-lateral triangles. Abdomen brown (Brazilian Guiana) . . . . . var. *alfkenii* (Ducke), p. 395.
—. Antenna with segments 1 2 dorsally black. Other characters as in var. *alfkenii* (Ducke) (S.E. Colombia and Guiana) var. *excrucians* var. n., p. 396.
—. Antennae with almost entire dorsal surface black or brown (except in some specimens of var. *trinitatis*). Propodeum with anterior-lateral triangles usually absent or faintly indicated in brown . . . . . 15.
15. Abdomen yellow-brown or with segments 2 or 3–6 black (E. Brazil to Paraguay) . . . . . var. *bahiae* var. n., p. 398.
—. Abdomen with anterior part of tergites black (rarely brown), contrasting with yellow posterior portion . . . . . 16.
16. Central stripe of propodeum nearly always narrow but continuous. Scutellum nearly always more black-marked, often with triangular mark close to but just separated from posterior margin. Tergite 1 usually only posteriorly pale (Paraguay) . . . . . var. *zikanii* var. n., p. 399.
—. Central stripe of propodeum rarely continuous. Scutellum usually with only narrow anterior margin and central line black. Tergite 1 yellow with central half (rarely two-thirds) brown or black (B.W.I.: Trinidad, Colombia to British Guiana) . . . . . var. *trinitatis* var. n., p. 397.
—. Resembles var. *zikanii* very closely, but tergites 1–2 red-brown marked, 3–5 black marked (Paraguay and Matto Grosso) *M. paraguayensis* Zikán, p. 379.

Key to the species of the subgenus *Omega* Saussure.

1. Abdominal tergite 1 (fig. 70) very long and narrow. Mesonotum with numerous strong and fine punctures, pleura with very strong punctures 2.
–. Abdominal tergite 1 not very long and narrow, distinctly expanded posteriorly. Thorax with very numerous fine punctures and also with sparse large but not very deep punctures. Mid tibia with one spur (S.E. Brazil) . . . . . 3.
2. Abdominal tergite 1 almost completely parallel-sided. Propodeum much more coarsely punctured. Proepisternum strongly reflexed anteriorly. Mid tibia with one spur (Brazil) . . . . . *M. filiformis* (Sauss.), p. 402.
–. Abdominal tergite 1 (fig. 72) distinctly though not strongly expanded posteriorly. Propodeum more sparsely and finely punctured. Proepisternum not reflexed anteriorly. Mid tibia with two spurs (B.W.I.: Trinidad, to Paraguay) . . . . . *M. punctatus* (Ducke), p. 404.
3. Larger, stouter insect. Abdominal tergite 1 (fig. 71) less expanded. Thorax more yellow marked . . . . . *M. buyssoni* (Ducke), p. 403.
–. Smaller, less robust insect. Abdominal tergite 1 more expanded. Thorax almost without yellow markings (not seen; characters taken from Zikán) . . . . . *M. cristatus* Zikán, p. 401.

Key to the species of the subgenus *Monogynoecus* Rich.

1. Pronotum with traces of a minute lateral fovea, keel a little stronger than in *M. lecointei* (Ducke). Mesopleuron quite dull. Dark markings of head entirely nebulous in ♀; dark mark in front of pronotal keel one-third to one-half as wide as head. ♂ with antennal segment 1 thicker, 11 and 12 distinctly longer than 10 (British Guiana) *M. foveatus* sp. n., p. 413.
–. Pronotum with no trace of lateral fovea. Mesopleuron somewhat shining. Part of dark markings of head well defined. ♂ with antennal segment 1 thinner, 11 and 12 not longer than 10 . . . . . 2.
2. Pronotal keel hardly traceable; black mark in front of it two-thirds as wide as head. Upper division of metapleuron acutely produced along meso-metapleural suture . . . . . *M. lecointei* (Ducke), p. 406. 3.
–. Pronotal keel sharp throughout, though little raised, black mark in front of it one-third as wide as head. Upper division of metapleuron obtusely produced along the meso-metapleural suture (British Guiana to Brazil: N.W. Amazons) . . . . . *M. metoecus* Rich., p. 411.
3. Abdomen with tergites anteriorly brown (British Guiana: s. bank of R. Mazaruni (and probably also of Essequibo) to Brazil: Bahia) var. *lecointei* (Ducke), p. 408.
–. Abdomen with tergites anteriorly black (British Guiana: n. bank of R. Essequibo) . . . . . var. *guianensis* var. n., p. 409.

Key to the species of the group of *M. collaris* (Ducke), ♀♀.

1. Mesopleuron a little shining, though finely and closely punctured; abdomen also more shining. Pronotal keel as in *M. collarellus* Rich. Abdomen black and yellow, mesopleuron yellow, segment 5 of hind tarsus nearly always black (British Guiana) . . . . . *M. superus* Rich., p. 423.
–. Mesopleuron absolutely dull, more closely punctured or granulate; abdomen duller. Segment 5 of hind tarsus only black in specimens with mesopleuron much black-marked or with abdomen black . . . . 2.
2. Distance from lateral extremities of pronotal keel (fig. 77), measured along an imaginary production of keel to meet posterior pronotal margin, shorter than distance from posterior-dorsal angle of pronotum to this imaginary intersection. Mesopleuron more granulate, sculpture on the average weaker. Abdomen brown and yellow (Brazil: Obidos to Panama) . . . . . *M. collarellus* Rich., p. 421.
–. Distance from lateral extremity of pronotal keel (fig. 78) to posterior margin of pronotum as long as or a little longer than distance from postero-dorsal angle of pronotum to imaginary intersection (except in var. *melanopygus*). Mesopleuron very closely and usually more strongly punctured . . . . . *M. collaris* (Ducke), p. 416. 3.
3. Clypeus yellow; mesopleuron nearly all yellow; abdomen yellow-brown. Mesopleural sculpture weaker. (Like *M. collarellus* Rich. but sides of pronotum, scutellum and postscutellum with more black. Brazil: Amazons) . . . . . var. *collaris* (Ducke), p. 417.
–. Clypeus yellow; mesopleuron nearly all yellow; abdomen entirely black. Pronotal keel as in *M. collarellus* Rich. (Peru) var. *melanopygus* var. n., p. 419.
–. Clypeus nearly always with a black-marked disc; mesopleuron extensively ferruginous or black-marked; abdomen black or red-brown and yellow. Mesopleural sculpture stronger (Brazil: Rio de Janeiro southwards) var. *parallelogrammus* Zikán, p. 418.

Key to the species of the group of *M. collaris* (Ducke), ♂.

1. Antennal segments not ciliated, 13 strongly dilated at tip, beneath whitish with distal third sharply black . . . . . *M. superus* Rich., p. 423.
–. Antennal segments 3–8 with long cilia . . . . . 2.
2. Antennal segment 13 not dilated, whitish beneath, with distal quarter sharply black; cilia a little longer. Pronotal keel as in ♀ *M. collarellus* Rich., p. 421.
–. Antennal segment 13 dilated distally, whitish beneath or indistinctly black-marked; cilia shorter. Pronotal keel as in ♀ *M. collaris* (Ducke), p. 416. 3.
3. Clypeus yellow; mesopleuron nearly all yellow var. *collaris* (Ducke), p. 417.
–. Clypeus with disc black-marked; mesopleuron with large black or ferruginous markings . . . . . var. *parallelogrammus* Zikán, p. 418.

Key to the species of the group of *M. surinamensis* (Sauss.).

1. Pronotal keel (fig. 99) dying away gradually at sides and not reflexed there. ♀ clypeus feebly bidentate at tip of produced part. ♂ antennae as in *M. surinamensis* (Sauss.) (British Guiana) . . *M. sylvestris* sp. n., p. 430.
–. Pronotal keel (fig. 100) ending laterally in small lobes which are a little reflexed. ♀ clypeus not bidentate . . . . . 2.
2. Clypeus (fig. 93) less produced in ♀. Abdominal tergite 1 (fig. 95) relatively short and thick (intermediate between *M. confusus* Zikán and *M. garbei* Zikán). Mesopleuron more shining. ♂ antenna with segment 13 as long as 4 (Mexico to Panama) . . . . . *M. cleomenes* sp. n., p. 432.
–. Clypeus less produced. Other characters as in *M. garbei* Zikán. (Antenna orange; abdominal tergites inconspicuously yellow banded; propodeum with lateral black stripes. Bolivia) *M. garbei* Zikán var. *xanthocerus* var. n., p. 439.
–. Clypeus more produced (fig. 94). Mesopleuron dull and granulate. ♂ antenna with segment 13 clearly shorter than 4 . . . . . 3.
3. Abdominal tergite 1 (fig. 96) very short and thick, especially in profile. Insect largely black (Brazil) . . . . . *M. confusus* Zikán, p. 433.
–. Abdominal tergite 1 (fig. 98) intermediate . . . *M. garbei* Zikán, p. 433. 4.
–. Abdominal tergite 1 (fig. 97) long and thin, especially in profile *M. surinamensis* (Sauss.), p. 435. 5.
4. Abdominal tergites uniform orange-brown (S. Brazil) var. *garbei* Zikán, p. 438.
–. Abdominal tergite 2 reddish, 3–6 black with posterior yellow bands (Brazil: Matto Grosso) . . . . . var. *tricolor* var. n., p. 439.
5. Abdominal tergites clearly banded with black (British Guiana) var. *occidentalis* var. n., p. 435.
–. Abdominal tergites brownish-yellow, the anterior part of each very little darker than the posterior (Surinam to Amazonia) var. *surinamensis* (Sauss.), p. 436.

Key to the species of the group of *M. prominulus* Rich.

1. ♂ antennal segment 3 much longer than 1 + 2, 11 and 12 twice as long as broad. Abdominal tergite 1 (fig. 91) (♂♀) a little broader and less campanulate. Propodeum with black lateral stripes, pleural sutures partly black (Colombia) . . . . . *M. bequaertii* sp. n., p. 428.
–. ♂ antennal segment 3 as long as 1 + 2, 11 and 12 as long as broad. Abdominal tergite 1 (fig. 89) (♂♀) narrower, more campanulate. Propodeum with only black central stripe, pleural sutures yellow *M. prominulus* Rich., p. 425. 2.

2. Abdominal tergite 1 shorter and broader (British Guiana and E. Bolivia) var. *prominulus* Rich., p. 425.
–. Abdominal tergite 1 longer and narrower (fig. 90) (Peru) var. *tenuis* var. n., p. 427.

Key to the varieties of *M. cerberus* Ducke.

1. Abdomen with each tergite banded with black and yellow (British Guiana) var. *acheron* Rich., p. 444.
–. Tergites 2–6 black, sternites yellow (Surinam and Amazons) var. *cerberus* Ducke.
–. Tergites and sternites 1–2 yellow; tergites 3–6 black, half sternite 3 and whole of 4–6 black (Brazil: S. Paulo) . . . . var. *styx* Rich., p. 445.

Key to the species of the groups of *M. artifex* (Ducke) and *M. iheringii* Zikán.

1. Pronotal keel (fig. 115) strongly concave anteriorly. (Large species with 14 hamuli. Malar space one-third as long as width of antennal socket. Clypeus (fig. 105) four-fifths as long as broad. POL : OOL = 5 : 12 (fig. 106). Abdominal tergite 1 relatively broad. Brazil: Obidos) *M. artifex* (Ducke), p. 446.
–. Pronotal keel at most a little concave anteriorly. Clypeus about as long as broad. (Smaller species with 7–12 hamuli. Malar space at narrowest one-quarter as long as width of antennal socket) . . . . . 2.
2. Abdominal tergite 1 (fig. 113) narrower, less campanulate. Pronotal keel anteriorly convex, laterally dying away very gradually. Antenna black dorsally. Posterior ocelli (fig. 109) separated by about their diameter from one another. (♀ with 8 hamuli. Paraguay) *M. thrypticus* sp. n., p. 451.
–. Abdominal tergite 1 broader, more campanulate . . . . . 3.
3. Mainly black species. Sculptures of mesopleuron strongly granulate. Occiput somewhat margined laterally. Abdominal tergite 1 (fig. 102) very strongly campanulate (Rio de Janeiro) . *M. iheringi* Zikán, p. 440.
–. Mainly yellow species. Mesopleuron very finely sculptured. Occiput not margined . . . . . 4.
4. Larger species with 10–12 hamuli. Wings dark yellow-brown, at least along costa. Abdominal tergite 1 (fig. 111) broader. (Lateral extremities of pronotal keel a little reflexed, keel straight or a little concave anteriorly. Clypeus a little longer than broad. Posterior ocelli (fig. 107) separated by a little less than their diameter. POL : OOL = 1 : 3. Antenna orange. British Guiana) . . . . . *M. oecothrix* Rich., p. 448.
–. Smaller species with 7–11 hamuli. Abdominal tergite 1 (fig. 112) narrower. 5.
5. Lateral extremities of pronotal keel (fig. 116) a little reflexed, keel straight or a little concave anteriorly. Clypeus a little longer than broad. Posterior ocelli separated by a little more than their diameter (fig. 108). POL : OOL = 1 : 2·5. Antenna black or dark dorsally (Panama and British Guiana) . . . . . *M. synoecus* Rich., p. 450.
–. Pronotal keel (fig. 117) a little convex anteriorly, a little weaker, lateral extremities not reflexed. Abdominal tergite 1 (fig. 114) intermediate between last two species. Clypeus as long as broad. Posterior ocelli separated by their diamter. POL : OOL = 1 : 3. Antenna dorsally black. ♀ hamuli 8–9 (Peru, Bolivia). . *M. peruviensis* sp. n., p. 451.

6. Descriptions of Species.

Subg. *Mischocyttarus* Saussure, [1853] : 19.[8]

Genotype. *Zethus labiatus* Fabricius, [1805] by designation of Ashmead, 1902.

It is probable that the two groups which I have placed in this subgenus are not really very closely allied. They seem to have little in common other than the characters given in the key (p. 306). Brèthes (1923 : 16) described a *Clypeopolybia duckei* g. n., sp. n. The genus is clearly synonymous with *Mischocyttarus* but it is impossible to say with what subgenus, probably with either *Kappa* Sauss. or *Megacanthopus* Ducke. The specific name is preoccupied by *M. duckei* (du Buysson, 1908).

Group of *M. labiatus* (Fab.) (text-figs. 1–18).

Characters of the adults given in the key (p. 306). The ♂ genitalia of five species have been studied. They are compared with *M. superus* Rich. (p. 414), which is described and figured in detail. The species appear to differ chiefly in the shape of the digitus (nomenclature of Snodgrass, 1941) but this is difficult to see and varies with the view-point, so that it is not a very useful character. It is a character of the group that the ventral teeth of the aedeagus extend right up to the proximal ventral hook, and that the digitus is relatively short and broad.

Larva. Only a single specimen has been examined, a dried-up fragment from the nest of *M. rotundicollis* (Cam.) (Brazil : Petropolis, 27.vii.1923 (*H. Cott*), B.M.). It is only possible to make out that there are two ventral lobes on the first abdominal segment.

Nest. The species of this group agree in having a long central petiole to the comb which is composed of not many (20–30) cells arranged in a circle. The cells are unusually long, as might be expected from the shape of the adults.

Mischocyttarus melanarius (Cam.).

Polybia melanaria Cameron, 1906 : 153.
Megacanthopus longipetiolatus Cameron, 1912 : 218.

♀. Dark reddish-brown to blackish-brown, antennae (sometimes quite pale) and articulations of legs redder. Wings dark or rather dark brown. Surface of head and thorax with moderately dense, appressed, pale brown pubescence, longer on propodeum; pubescence on abdomen very short and less close than in allied species, abdomen therefore usually a little shining, even beneath petiole pubescence nearly always relatively short and semi-recumbent; sternites 5–6 with dense pubescence. Length (H. + Th. + T1 + T2) 15·0–17·0 mm.

Head dull, finely granulate, unpunctured, produced ventral part of clypeus smoother and more shining. Mandibles moderately shining, with sparse, shallow punctures, proximal half hardly flattened, ventrally not sharp-edged, four distal teeth. Malar space at narrowest point about half as long as width of antennal socket. Width of clypeus where eyes approach most closely about three-quarters its length, ventral margin distinctly triangularly produced, the production truncate and feebly bidentate, lying at a lower level than disc. Tentorial pits a little nearer to eyes than to antennal sockets. Antennal segments 2 + 3 = 1. Distance between antennal sockets about the same as that from outer edge of socket to eyes. Eyes equidistant dorsally and ventrally, only in contact with clypeus at a point. Ocelli of

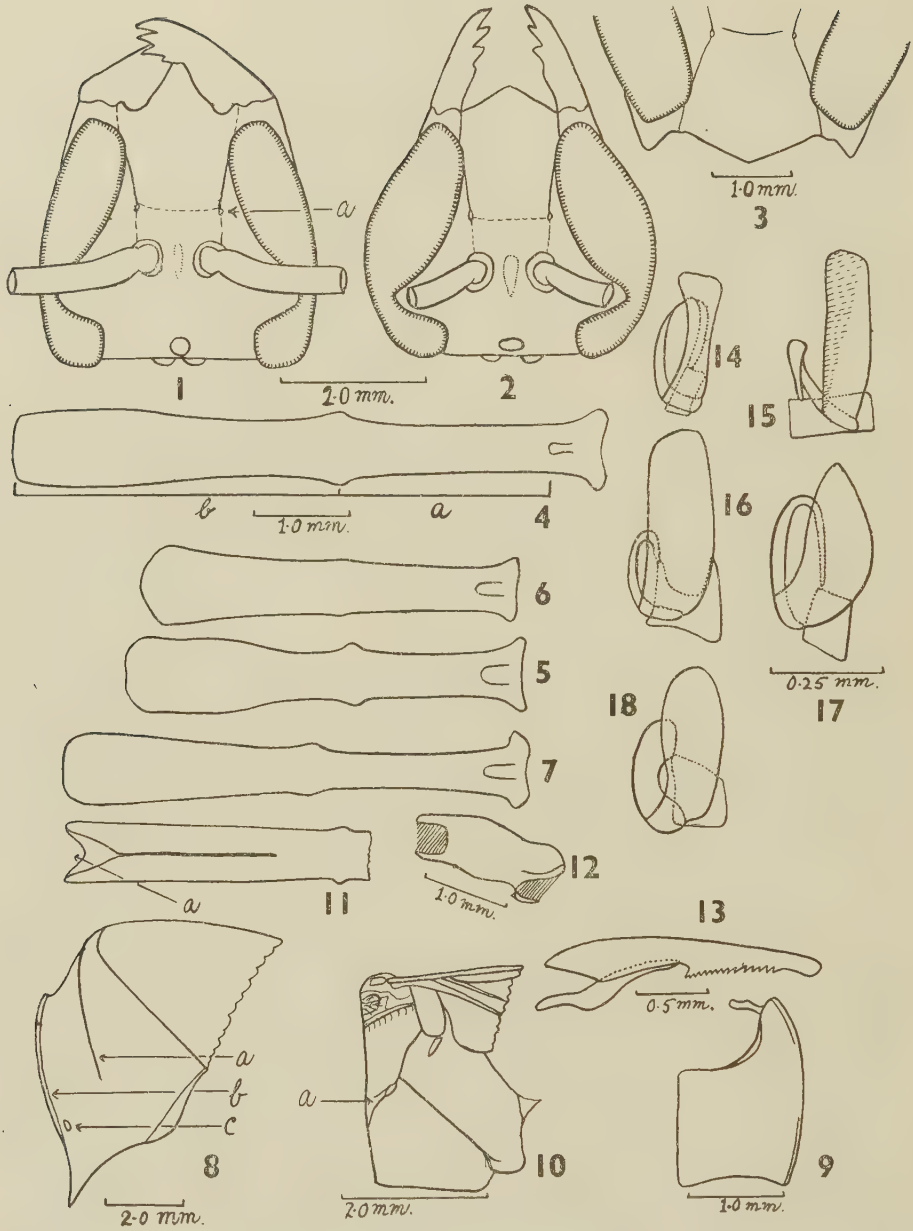
[8] For this and other dates of the names published by Saussure in *Études sur la famille des Vespides*, see Griffin (1939).

moderate size, in a triangle of which posterior side is just shortest, posterior pair separated by about their diameter, POL : OOL = 1 : 2. - Occiput not margined, its width behind eyes dorsally nearly four times distance between posterior ocelli, tempora two-thirds as broad as eye. Thorax + propodeum distinctly more than twice as long as broad, surface dull, granulate unpunctured. Pronotum with anterior margin weakly raised, preceded by feeble, obtuse-edged furrow, lateral fovea distinct; keel weak, though just continuous, feebly concave posteriorly. Anterior margin of proepisternum not raised, sides not margined. Upper division of metapleuron sending acute process along meso-metapleural suture. Postscutellum somewhat flattened, but in profile not forming a continuous curve with the scutellum. Propodeum with central furrow not very broad (broader below), deep, with central keel often weak, furrow ending dorsally at one-quarter its length from postscutellum; plate of valve triangular, as broad as high, dorso-lateral margin obtuse (13 spec.), subacute (5 spec.) or acute (15 spec.). Mid tibia with two spurs of about equal length; mid tarsi with segment 3 strongly asymmetrical. Hind tarsi with inner lobe of segment 3 considerably longer than outer lobe of 4 which is rather more than half as long as its inner lobe, claws strongly asymmetrical, inner one longer, broader and flattened beneath. Length of fore-wing 14·5–19·0, average 16·44 mm.; hamuli 16–25, average 20·1. Abdominal petiole extremely long (longer than hind femur + trochanter) and nearly parallel-sided, distal half a little expanded but then contracted again, posterior margin about one and a half times as broad as anterior, spiracular ratio = 3 : 4, spiracles usually distinctly projecting; petiole ventrally rounded, flattened, distal triangular area one and a half times longer than broad, membranous emargination twice as wide as deep. Tergite 2 only gradually expanded, a little longer than broad.

♂. Resembles ♀ except :—mandibles less punctured, most dorsal of four distal teeth quite or nearly obsolete. Malar space rather shorter, about one-third as long as width of antennal socket. Clypeus with dense outstanding pubescence, rather narrower, ventral margin rounded, feebly produced. Tentorial pits at least twice as near to eyes as to antennal sockets. Antennal segment 3 clearly longer than 1, 4 one and a half times as long as broad, 12 only a little shorter, 13 two and a half times as long as broad, shorter than 11–12, antennae somewhat flattened and shining beneath, distally loosely coiled, segments not ciliated. Eyes considerably closer ventrally than dorsally, broadly in contact with clypeus. Occiput behind eyes dorsally about three times as wide as distance between posterior ocelli; tempora about half as wide as eye. Dorso-lateral margin of valve-plate of propodeum obtuse (5 spec.), subacute (3 spec.) or acute (12 spec.). Length of fore-wing 14·0–19·0, average 16·8 mm.; hamuli 14–22, average 18·1. Sternite 7 flattened, posteriorly widely rounded; 6 and 7 with dense pubescence; pubescence beneath petiole also often longer and denser; genitalia resemble those of *M. labiatus* (Fab.).

Specimens examined :—Mexico : Morelos, Cuernavaca, 1–6.viii.1921, ♂ (C.); Vera Cruz, Orizaba, ♂ (coll. Konow, D.E.I.), Cordoba, 20.i.1909, ♀ (*F. Knab*) (J.B.), Atoyac, iv., ♀ (*H. H. Smith*) (B.M.), no precise loc. 2 ♂ (*Schumann*) (B.M.); Tabasco, Teapa, iii., ♂, 2 ♀, iii., 6 ♀, iv., ♀ (*H. H. Smith*) (B.M.); state and locality unknown, 2 ♀ (Wilson Saunders coll., O.), 2 ♂ (B.M.), ♀ (*Ehrenberg*) (B.), ♀ (*Stobbe*) (B.), 3 ♂ (*E. A. Purpus*) (B.). Guatemala : Mocá, Guatalón, 1000 m., iii.–iv.1931, 3 ♀ (J.B.); Sta. Emilia Pochuta, 1000 m., ii.–iii.1931, ♀ (J.B.); S. Geronimo, ♂ (*G. C. Champion*) (B.M.); Vera Paz, Lanquin, ♀ (*G. C. Champion*) (B.M.); Mirandilla, 1700 ft., ♀ (*G. C. Champion*) (B.M.). British Honduras : Punta Yeacos, ix.1913, ♀ (*F. L. Davis*) (B.M.); Belize, ♀ (P. Cameron coll., B.M.) [type of *Polybia melanaria* Cam.], Belize,[9]

[9] This specimen bears two labels, an upper one " Belize " and a lower one " Brit. Guyana." In the text, Cameron describes *M. longipetiolatus* from Costa Rica. I believe that Belize is most likely the correct locality.



Figs. 1–18.

Fig. 1. Anterior view of head, *M. labiatus* (Fab.) ♀. a. Tentorial pit.
2. The same, ♂.
3. Part of head with clypeus, *M. gynandromorphus* sp. n. ♀.
4. Dorsal view of abdominal tergite 1, *M. labiatus* (Fab.) ♂. a/b = Spiracular ratio.
5. The same, *M. smithii* Sauss. ♂.
6. The same, *M. drewseni* Sauss. ♀.
7. The same, *M. rotundicollis* (Cam.) ♀.
8. Dorso-lateral view of pronotum, *M. labiatus* (Fab.) ♀. a. Keel. b. Anterior margin. c. Fovea.

♂ (P. Cameron coll., B.M.) [type of *Megacanthopus longipetiolatus* Cam.]. Rep. Honduras : Prieta, 5.iv., 3 ♀, 6.iv., ♀, 8.iv.1924, ♀, 2 ♂ (J.B.); Pto. Castillo, 30.iii., ♂, 26.iii.1924, ♂♀ (J.B.); Corocito, 13.iv.1924, ♂ (J.B.). Costa Rica : Cache, ♀ (*H. Rogers*) (B.M.); Alajuela, ♀ (*Alfaro*) (J.B.); La Fuente, 3 ♀ (*Alfaro*) (J.B.); Suretka Prov., Limon, 26.iv.1924, 2 ♂, 2 ♀ (*J. C. Bradley*) (C.). Panama : La Chorrera, 2 ♀ (B.M.).

This species meets *M. labiatus* (Fab.) in Panama and some specimens are not easily referable to either form. It might be better to treat the present species as a geographical race of *M. labiatus* (Fab.).

Mischocyttarus labiatus (Fab.).

Zethus labiatus Fabricius, [1805] : 284.
Mischocyttarus labiatus Saussure, [1853] : 20.

♀♂. Resembles *M. melanarius* (Cam.) except in the following particulars :—Colour of body resembling paler specimens, abdomen never really black. Wings tending to be darker, sometimes with a purplish tinge. Pubescence beneath petiole denser, longer and less recumbent, on abdomen usually denser, so that abdomen tends to be duller.

♀. Clypeus tending to be more produced. Keel of pronotum usually stronger centrally. Dorso-lateral margin of valve-plate of propodeum obtuse (2 spec.), subacute (15 spec.) or acute (27 spec.) (11 not recorded). Length of fore-wing 14·5–20·0, average 17·51 mm.; hamuli 13–21, average 17·85.

♂. Dorso-lateral margin of valve-plate obtuse (7 spec.), subacute (8 spec.), acute (25 spec.). Length of fore-wing 13·0–19·0, average 16·46 mm.; hamuli 11–19, average 15·28. Genitalia (fig. 14) resemble those of *M. superus* Rich. (fig. 85) but the parameral spine and cuspis have longer and more numerous setae. The digitus has a characteristic shape, but this varies much with the view-point. The teeth on the ventral side of the aedeagus are about 15 in number and extend right up to the ventral hook.

Specimens examined :—Panama : Gorgona Is., 2° 59′ N., 78° 20′ W., vii.1924, 2 ♂ (*L. E. Cheesman*) (B.M.); Canal Zone, Barro Colorado Is., 25.x., ♂ (*M. Bates*) (J.B.), same loc., 14.iii.1936, ♂ (*F. E. Lutz*) (J.B.), same loc., 11.vii.1934, ♀ (*O. E. Shattuck*) (J.B.). Colombia : Dept. Meta, Restrepo, 500 m., 3 ♂, ♀ (*J. Bequaert*) (J.B.); Dept. Magdalena, Rio Frio, Cerro Patron, 4000 ft., 12.ix.1927, ♂ (*G. Salt*) (J.B.), Tucurinca, 5–6.i.1927, 2 ♀ (*G. Salt*) (J.B.), Santa Marta, 20.ix.1927, ♀ (*G. Salt*) (J.B.); Dept. Boyaca, Muzo, 900 m., 1936, ♂ (J.B.), Muzo, 3 ♀ (*Rohde*) (B.), Bogota, ♂♀ (*Lindig*) (B.); no precise loc., ♂ (*Moritz*) (B.). Peru : N. Peru, Maranon district, Mishuyacu, 4 ♀ (B.), Huallaga, Jumbatis, 350 m., ♀ (D.E.I.); Calanga, 1934, ♂ (*Harttig*) (D.E.I.), Valle Chanchamayo, 800 m., 1.iv.1939, ♂♀ (*Weyrauch*) (J.B.); Putamayo district, La Chorrera, 17–20.viii.1920, ♂♀ (C.); Col Perene, El Campamiento, 11.vi., ♀, 18.vi.1920, ♀ (C.), Col Perene, Hacienda San Juan, 16.vi.1920, ♀ (C.). Bolivia : Dept. Sta. Cruz, Buenavista, 450 m., ♂ (J.B.); Coroico, ♂♀ (B.). Venezuela : Pakaraima Mts., ♀ (*J. G. Myers*) (J.B.).

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9. Ventral view of left proepisternum, *M. labiatus* (Fab.) ♀.
10. Left metapleuron, *M. labiatus* (Fab.) ♀. a. Ventral process of dorsal division.
11. Ventral view of posterior part of sternite 1, showing the membranous emargination (a), *M. labiatus* (Fab.) ♀.
12. Left fore coxa from the side, *M. labiatus* (Fab.) ♀.
13. Aedeagus from the left, *M. rotundicollis* (Cam.) ♂.
14. Ventral view of right digitus, *M. rotundicollis* (Cam.) ♂.
15. The same, *M. drewseni* Sauss. ♂.
16. The same, *M. labiatus* (Fab.) ♂.
17. The same, *M. tomentosus* Zik. ♂.
18. The same, *M. smithii* Sauss. ♂.

British Guiana: Rupununi, 5.ii.1934, ♂, no date, ♂♀ (*J. G. Myers*) (J.B.); Mackenzie, 23.vi.1927, 3 ♂ (C.); Cuyuni R., Kamaria landing, 23.xi., ♀, 25.xi.1929, ♀ (*Oxford Univ. Exped.*) (B.M.), Kalacoon, 20.x.1920, ♀ (C.), just below Kamaria, 20.ix.1937, ♂ (*Richards and Smart*) (B.M.), Kartabo, vii.–viii.1920, ♀ (*W. M. Wheeler*) (J.B.); Mazaruni Settlement, second-growth forest, 15.viii., 16.ix., 26.ix.1937, 3 ♀ (*Richards and Smart*) (B.M.); Essequibo R., Bartica, 21.ii.1913, ♀ (J.B.), Bartica, 23.i., ♀, 4.iii., ♂, 18.iii.1913, ♀ (C.); Potaro R., Kaieteur Savannah, 6–10.ix.1937, 2 ♂, 4 ♀ (*Richards and Smart*) (B.M.), high forest fringing the savannah, 6–10.ix.1937, ♂, 3 ♀ (*Richards and Smart*) (B.M.); no precise loc., ♀ (*Schomburgk*) (B.). Dutch Guiana: Paramaribo, 9.iii.1909, ♀ (*C. Heller*) (B.); Para district, Boven, Zanderij Is., 19–25.iv.1927, 4 ♂, 5 ♀ (C.); no precise loc., ♂ (*Cordna*?) (B.). French Guiana: Bas Maroni, St. Laurent de Maroni, ♂ (*Le Moult*) (J.B.); Les Hattes, ♂ (*Le Moult*) (J.B.); Charvein, ♀ (*Le Moult*) (J.B.); Nouveau Chantier, ♀ (*Le Moult*) (J.B.); no precise loc., ♀ (*Lacordaire*) (B.). B.W.I., Trinidad: Sta. Cruz valley, 4 miles N.N.E. Port of Spain, ♀ (*N. A. Weber*) (J.B.); no precise loc., 24.i.1932, ♀ (*D. Vesey FitzGerald*) (J.B.). Brazil: "Upper Amazons," ♀ (F. Smith coll.) (B.M.), ♀ (Wilson Saunders coll.) (O.); Pará, ♀ (*Sieb.*) (B.); Teffé, 26.ix.1904, ♂ (*A. Ducke*) (B.); Para Soure, Marajo, ♂ (*O. Bertram*) (B.); Parintins, ♂ (*Knudsen*) (B.); Tonantins, Rio Solimões, ♂ (D.E.I.); Rio Machados, ♀, 2 ♂ (D.E.I.); no loc., ♂ (D.E.I.).

Specimens found in British Guiana and eastwards have the margin of the propodeal valve-plate nearly always acute, specimens found to the westwards have the margin nearly always obtuse or sub-obtuse.

The original description of *Zethus labiatus* Fabricius, [1805]: 284 runs as follows:—

"Z. obscure ferrugineus, clypeo cinereo pubescente. Habitat in America meridionali Dom. Smidt. Mus. Dom. de Sehestedt. Paullo minor Z. macilento. Antennae nigricantes, articulo primo ferrugineo. Corpus totum obscure ferrugineum, clypeo solo cinereo pubescente, nitidulo. Alae obscurae."

I sent Dr. K. L. Henriksen male and female specimens of *M. labiatus* (as described above), *M. tomentosus* Zikán, *M. rotundicollis* (Cam.), and *M. melanarius* (Cam.) and he kindly compared them with the two specimens of *Z. labiatus* in Sehestedt's collection at Copenhagen; he writes that they clearly belong to the species I have called *M. labiatus* (Fab.); he also states that one specimen has 14 hamuli on the left wing and 13 on the right; the other had 16 on the right wing.

Dr. J. Bequaert suggests that this is the same as *M. labiatus* Zikán, 1935 and I think he is right.

There are many records of the biology of what has been called *Mischocyttarus labiatus*, but in nearly all cases it is uncertain which of the species now recognised in this group is referred to. FitzGerald (1938: 183–5; specimens seen xii.1938) found it commonly in several localities in Trinidad. The nests were usually hidden in crevices in banks. The nest consisted of a circular comb suspended from a long (32 mm.) central petiole which was thin, wire-like and highly polished. Phorid flies were often found as scavengers or parasites in the cells.

Rau (1933: 133, fig. 62) describes nests of this species from Barro Colorado Is., Panama. Though I have not seen his specimens, I have seen several others from the island. Two nests were attached to large thorns of the bayonet palm 6–7 ft. from the ground, one in a clearing, the other in dark forest. Three others were attached beneath a bracket fungus on a vertical tree trunk. One

of these had 4 newly begun empty cells, 4 shallow ones containing eggs, two with half-grown larvae and two with pupae. The petiole was 38 mm. long and very thin and the completed cells were 25 mm. long. The texture of the paper was very coarse and it appeared to have large grains of unchewed wood mixed with it.

In British Guiana, we found the species rather common in second-growth forest or in modified high forest which was lighter than usual, but no nests were found.

The following references to nests of *M. labiatus* cannot be referred with certainty to any one of the species now recognised :—Ducke (1904 : 364), (1906 : 687), (1907 : 184, pl. 2, fig. 3), R. von Ihering (1904 : 242), de Saussure (II, 1853 : pl. 3), Williams (1928 : 162–3, pl. 31, fig. 225), Strand (1912 : 321).

Mischocyttarus tomentosus Zikán, 1935 : 155.

♀♂. Resembles *M. labiatus* (Fab.) except in the following particulars :—Wings nearly always much paler, often hyaline with a yellow streak along the costa. Pubescence of thorax forming an unusually dense, silky tomentum; pubescence beneath abdominal petiole less conspicuous. Keel of pronotal collar stronger, especially in the centre, where it is considerably higher than at sides. Abdominal petiole often a little longer and narrower.

♀. Clypeus with ventral margin tending to be less impressed and less produced; tempora and occiput a little narrower. Dorso-lateral margin of valve-plate of propodeum obtuse (6 spec.), subacute (3 spec.) or acute (1 spec.). Length of fore-wing 17·0–19·0, average 17·85 mm.; hamuli 14–19, average 15·7.

♂. Dorso-lateral margin of valve-plate obtuse (7 spec.), subacute (2 spec.) or acute (1 spec.). Length of fore-wing 14·0–16·5, average 15·6 mm.; hamuli 12–16, average 13·9. Genitalia (fig. 17) appear to differ somewhat from *M. labiatus* (Fab.) in the details of the digitus and there are about 17 ventral teeth on the aedeagus.

Specimens examined :—Peru : Iquitos, 31.vii.1920, 2 ♂ (C.), ♀ (*H. Bassler*) (B.); La Sombra, 22.viii.1920, 2 ♂ (C.); Col Perene, El Campamiento, 21.vi.1920, ♀ (C.); Maranon district, Mishuyacu, ♂, 3 ♀ (B.). Brazil : Pará, ♀ (Wilson Saunders coll.) (O.), ♂ (F. Smith coll.) (B.M.), Pará, 19.iii.1893, ♂, no date, ♂♀ (*Schulz*) (B.), Rio de Pará, Mosqueiro, 6–8.iii.1896, 2 ♂ (*E. E. Austen*) (B.M.); Santarem, ♀ (B.M.); Villa Nova, ♀ (B.M.); Teffé, 9.ix.1904, ♀ (*A. Ducke*) (B.).

M. tomentosus was described by Zikán from a single female with the data :—Brazil : Espirito Santo, 1906 (*E. Garbe*). The type is in the Museu Paulista. Dr. J. Bequaert pointed out to me the probable identity of the specimens recorded above with Zikán's species.

Mischocyttarus smithii Saussure, 1853 : 21.

Megacanthopus violaceipennis Cameron, 1912 : 217.

♀. Black. Wings dark brown with strong violet reflections. Head and thorax with close, fine pale pubescence; that on abdomen still closer and finer, beneath petiole very short and appressed. Length (H. + Th. + T1 + T2) 15·0 mm. Structurally resembles *M. melanarius* (Cam.) but ventral margin of clypeus more rounded, less impressed, clypeus a little longer compared to its width; tentorial pits twice as near to eyes as to antennal sockets; ocelli separated by rather less than their diameter; occiput and tempora a little narrower. Keel of pronotum a little stronger, nowhere interrupted, straight; dorso-lateral margin of valve-plate of propodeum acute. Length of fore-wing 19·5, 20·0 mm.; hamuli 16, 18. Abdominal petiole shorter, more expanded from distal third, spiracle much more strongly projecting.

♂. Resembles ♀ but: antennae 3–13 reddish beneath; inner orbits from level of antennae to where eye meets clypeus, hind femora proximally and all coxae, reddish. Size rather smaller.

Most dorsal of four distal mandibular teeth obsolete; malar space a little shorter; clypeus with dense outstanding pubescence, ventral margin more obtuse; tentorial pits closer to eyes and eyes more in contact with clypeus; antennal segment 3 clearly longer than 1, 4 nearly twice as long as broad, as long as 11 + 12, antennae somewhat flattened beneath, distally feebly coiled, segments not ciliated; eyes less separated ventrally. Dorso-lateral margin of valve-plate of propodeum acute. Length of fore-wing 15·5–18·5, average 17·1 mm.; hamuli 14–17, average 15·7. Abdominal sternite 6 without dense pubescence. Genitalia (fig. 18) differ slightly from *M. labiatus* (Fab.) in the details of the digitus and there are 23 teeth beneath the aedeagus.

Specimens examined:—♂, 2 ♀, no data (? Amazons) (B.M.) [the ♂ is probably the type]. British Guiana: ♂ (Cameron coll.) [type of *Megacanthopus violaceipennis*]; Essequibo R., Moraballi Creek, Wallaba Bush, ♂ 19.ix., 2 ♂, 12.xi.1929 (*Oxford Univ. Exped.*). Surinam: ♂ (D.E.I.). Brazil: Amazons, ♂ (Wilson Saunders coll., O.).

Cameron (1912) states that the type of his *M. violaceipennis* is a female, but the description agrees better with the male, of which sex is a specimen marked as type. The Guiana specimens collected in 1929 were all obtained in "Wallaba Bush" (*Iperua* spp.), a type of forest which is peculiar in many ways. No specimens were seen in 1937, nor in other types of forest in 1929. Saussure described *M. smithii* from a male in the collection of F. Smith. In the British Museum collection are three old specimens without any labels; I suspect that the single male may really be the type. In any case, the species is recognisable from the description.

Mischocyttarus drewseni Saussure, 1857 : 317.

Megacanthopus atriceps Cameron, 1912 : 217.
?*Mischocyttarus mattogrossoensis* Zikán, 1935 : 156.

♀. Black; antennae 2–12 beneath, narrow posterior border of pronotum, postscutellum, considerable ventral area of propodeum, indefinite area at posterior margin of mesosternum, legs almost entirely, abdominal petiole, reddish; coxae darker; rarely thorax and abdomen almost entirely dark. Tegulae testaceous. Wings rather dark brown, often proximally yellowish tinged. Whole body with dense short pale appressed pubescence, that of head and thorax with yellowish silky reflections, that beneath petiole entirely appressed. Length (H. + Th. + T1 + T2) 12·0–15·0 mm.

Structurally resembles *M. melanarius* (Cam.) except in the following particulars:—mandibles with most dorsal of four distal teeth smaller; clypeus only a little longer than its least width, ventral margin less produced, rather or sometimes much more truncate, impressed smooth area narrow. Pronotal keel very weak, widely interrupted, feebly concave posteriorly. Central furrow of propodeum with no central keel, dorso-lateral margin of valve-plates acute (10 spec.), subacute (16 spec.) or obtuse (19 spec.). Mid tarsi with segment 3 little asymmetrical; hind tarsi with inner lobe of segment 3 not longer than outer lobe of segment 4, which is two-thirds as long as its inner lobe. Length of fore-wing 11·0–15·0, average 13·3 mm.; hamuli 12–21, average 15·4. Abdominal petiole clearly shorter, hardly as long as hind femur + trochanter, expanded almost imperceptibly from anterior margin to spiracles, thence almost parallel-sided, posterior margin usually less than one and a half times as broad as anterior margin.

♂. Resembles ♀ except:—most dorsal of four distal mandibular teeth obsolete; clypeus with dense outstanding pubescence, ventral margin regularly rounded; eyes considerably more approximated below, so that they are in longer contact with the clypeus which is

narrower, and tentorial pits much closer to eyes than to antennal sockets; antennae shorter than in ♂ *M. labiatus* (Fab.), etc., segment 3 = 1, 4 hardly more than one and a half times as long as broad, 5–12 about quadrate, 13 twice as long as broad, much shorter than 11 + 12. Abdominal sternites 5–7 with outstanding woolly pubescence, sternite 7 rounded. Genitalia (fig. 15) differ from *M. labiatus* (Fab.) in the relatively long and narrow digitus. There are about 17 teeth beneath the aedeagus. Dorso-lateral margin of valve plate of propodeum acute (7 spec.), subacute (6 spec.) or obtuse (12 spec.). Length of fore-wing 11·0–14·0, average 12·5 mm.; hamuli 12–18, average 14·6.

Specimens examined :—Bolivia : Samaipato, 2000 m., ♂♀ (*Steinbach*) (J.B.); Coroico, 3 ♂ (B.); La Paz, iii.1913, ♂ (*R. Strecher*) (B.). Peru : Dept. Cuzco, ♂♀ (*Garlepp*) (B.). Colombia : Bogota, ♂♀ (*Lindig*) (B.); no locality, ♀ (D.E.I.), ♂ (*Moritz*) (B.). Venezuela : Caracas, 3500 ft., 19.iii.1907, 2 ♀ (*G. B. Longstaff*) (O.), 3700 ft., 24.iii.1907, ♀ (*G. B. Longstaff*) (B.M.); Pakaraima Mts., R. Kukrema, ♀ (*J. G. Myers*) (J.B.). British Guiana : Georgetown, 10–15.xi.1920, ♀ (C.), ♀ (*Sadovnikova*) (B.), ♀ (Cameron coll., B.M.) [type of *Megacanthopus atriceps* Cam.]. Dutch Guiana : Paramaribo, 30.i.1920, ♀ (*Bollow*) (D.E.I.), ♀ (*Heller*) (B.), nr. Paramaribo, iii.1909, 2 ♀ (*C. Heller*) (B.). Brazil : Guiana, Almeirim, 9.iv.1903, ♀ (*A. Ducke*) (B.), Obidos, 10.i.1904, ♀ (*A. Ducke*) (B.M.), Tonantins, R. Solimões, ♀ (D.E.I.); Bahia, ♂♀ (*Gomez*) (B.), ♀ (*Freireyes*) (B.); Matto Grosso, Maracajú, iv.–v.1937, ♀ (*G. Fairchild*) (J.B.); Minas Gerães, Sete Lagos, 17.xii.1898, ♀ (B.), Bello Horizonte, 1–6.xi.1919, ♂ (C.), Diamentina, 14–18.xi.1919, 2 ♂, 1 ♀ (C.); Rio de Janeiro, Itatiaya, 700 m., 15.iv.1933, ♂ (*J. F. Zikán*) (J.B.), Sierra de Itatiaya, 12.i.1933, 4 ♂, 3 ♀ (*J. F. Zikán*) (D.E.I.), 92 km. from Rio, ♀ (coll. Le Moult) (J.B.), Alto Boa Vista, 30.x.1919, 2 ♂ (C.), Petropolis, 24–27.x.1919, ♂, 2 ♀ (C.); São Paulo, 24–6.ii.1912, 2 ♀ (*G. E. Bryant*) (B.M.), i.xi.1937, ♀ (*E. Lefevre*) (J.B.), St. Amaro, 12.viii.1923, ♀ (D.E.I.), Contarara, 10.vii.1923, ♀ (*W. S. Bristowe*) (O.W.R.), Bauru, 4.xii.1919, ♀ (C.); Santa Catharina, Theresepolis, ♂ (*Michaelis*) (B.), Neu-Bremen, Rio Laeiss, 13.xi.1922, ♂ (*Fr. Hoffmann*) (B.); Rio Grande do Sul, 2 ♀ (*R. von Ihering*) (B.M.); State unknown, Sierra de Boraima, 19.xii.1925, ♂ (*R. Flacher*) (D.E.I.); no locality, ♂♀ (Wilson Saunders coll., O.). Paraguay : San Bernardino, 6.x., ♂♀, no date, ♀ (*K. Fiebrig*) (B.); Asuncion, Sapucay, 12.i.1905, ♀ (*J. D. Anisits*) (B.), no date, 2 ♀ (*W. Forster*) (B.M.). Country doubtful : Salto Grande, ♂♀ (*Settow*) (B.); St. Cruz, ♀ (*Hensel*) (B.).

M. drewseni was described from " Brazil." I have not seen the type, but it is easily recognised by the distinctive colour-pattern. Occasionally, the abdomen is brown or even reddish-brown, but it is almost always clearly darker than the petiole. Sometimes almost the whole propodeum is reddish; such specimens have essentially the colour-pattern of *M. mattogrossensis* Zikán. That species (described from a single ♂, Brazil : Matto Grosso) may well be only a variety of *M. drewseni* Sauss.; apart from colour, no very clear-cut difference is mentioned in the original description.

M. drewseni is perhaps best recognised by the slight extent to which the petiolar spiracles project. Specimens approaching it in this respect sometimes occur in other species, but the variation is almost discontinuous.

Mischocyttarus drewseni var. **steinbachi** var. n.

Resembles var. *drewseni* Sauss. except in the following particulars :—antennal segment 1 beneath and 3 above reddish. Pronotum and dorsal half of mesoprepectus reddish. Propodeum mainly reddish, mesosternum with a larger indefinite red area. Abdomen dark red-brown, hardly darker than petiole. Length (H. + Th. + T1 + T2) 12·0 mm.

Pronotal keel becoming strong at sides and ending quite abruptly, interrupted over its

central third. Dorso-lateral margin of valve-plate of propodeum subacute. Length of fore-wing, ♀ 14·0, 17·5 mm., ♂ 12·5, 13·0 mm. Hamuli, ♀ 14, 15, ♂ 11, 14.

Type, BOLIVIA: Prov. Sara, ♀ (*Steinbach*) (J.B.). Allotype and paratype, BRITISH GUIANA: Mt. Roraima, ♂♀ (*J. G. Myers*) (*J. Bequaert*). PERU: Cuzco, 9.vii.1923, ♂ (*G. H. Wolcott*) (J.B.).

Apparently this is a variety which occurs mixed with var. *drewseni* in the north-western part of the range of the species.

Mischocyttarus drewseni var. **gigas** var. n.

Resembles var. *drewseni* Sauss. except in the following particulars:—Colour in general darker, only small postero-ventral areas of thorax reddish. Pubescence of mesosternum more conspicuous and silvery. Length (H. + Th. + T1 + T2) ♀ 12·0–14·0, ♂ 12·5 mm.

Length of fore-wing ♀ 15·5–17·0, average 16·5 mm., ♂ 13·0, 16·0. Hamuli ♀ 14–17, average 16·0, ♂ 15, 15. Dorso-lateral margin of valve-plates of propodeum ♂♀ acute.

Type, ARGENTINA: Jujuy, 11.ii.1920, ♀ (C.). Allotype, same place, ii.1920, ♂ (C.). Paratypes, ARGENTINA: Jujuy, 11.ii.1920, ♂, 2 ♀, ii.1920, ♀ (C.).

According to Ducke (1906 : 687) this species lives in fields and open places and was therefore not found in the State of Amazonas. He quotes R. von Ihering to the effect that the nest resembles that of *M. labiatus*. R. von Ihering (1904 : 242, pl. 5, fig. 4) states that the petiole of the nest is always finer than in *M. labiatus*, diameter at most 0·5 mm. and 25–35 mm. long. The nest is 60–70 mm. in diameter. The cells are 5·0 × 18·0–20·0 mm. Zikán (1935 : 174, pl. 2, fig. 7) figures a nest of *M. drewseni* but does not describe it or the habits of the wasp but he notes (: 174) that the cells may be used more than once for rearing larvae. Such cells can be recognised by the ring-like mark of the first cocoon. H. von Ihering (1897) notes that in south Brazil (south of the Rio Grande do Sul) the colonies of *Polistes* seem to break up in the winter while those of *Polybia* hibernate. A colony of *M. drewseni* found on 12 July had only 6 wasps, the others having flown away although large larvae and recently laid eggs were present.

Mischocyttarus rotundicollis (Cameron).

Megacanthopus rotundicollis Cameron, 1912 : 216.
Mischocyttarus gracilis Zikán, 1935 : 158.

♀. Dark red-brown; colour very uniform, little contrast between the various parts, face sometimes lighter, last 2–3 antennal segments usually orange. Wings rather dark brown. Whole body with moderately dense short pale pubescence, that on propodeum somewhat, on ventral half of clypeus distinctly longer; that beneath petiole distinctly outstanding; that on rest of abdomen very fine and dense, partly outstanding on sternites. Length (H. + Th. + T1 + T2) 13·0–15·0 mm.

Resembles *M. melanarius* (Cam.) except in the following particulars:—Least width of clypeus rather less than three-quarters its length, ventral margin a little less produced and less depressed. Ocelli often in an equilateral triangle. Keel of pronotum very weak, especially laterally. Dorso-lateral margin of valve-plate of propodeum obtuse (39 spec.), subacute (20 spec.) or acute (12 spec.). Mid tarsi with segment 3 little asymmetrical; hind tarsi with inner lobe of segment 3 not longer than outer lobe of segment 4 which is two-thirds as long as its inner lobe. Length of fore-wing 13·5–16·5, average 15·06 mm.; hamuli 11–20, average 15·92. Abdominal petiole a little shorter, anteriorly a little broader, posterior expansion usually more gradual with less contraction at posterior margin, spiracles distinctly though obtusely projecting.

♂. Resembles the female except :—mandibles less punctured, most dorsal of four distal teeth obsolete; malar space rather shorter; clypeus with dense outstanding pubescence, rather narrower, ventral margin rounded, hardly produced, not depressed; tentorial pits at least twice as near to eyes as to antennal sockets; antennal segment 3 just longer than 1, 4 one and a half times as long as broad, just shorter than 11 + 12, antennae somewhat flattened and shining beneath, distally loosely coiled, segments not ciliated; eyes considerably closer ventrally, broadly in contact with clypeus. Dorso-lateral margin of valve-plate of propodeum obtuse (4 spec.), subacute (6 spec.), acute (1 spec.). Hind tarsi with inner lobe of segment 3 relatively longer than in ♀, but shorter than in *M. labiatus* (Fab.). Genitalia (fig. 14) with digitus narrow as in *M. drewseni* Sauss.; aedeagus with about 15 teeth beneath. Length of fore-wing 11·0–15·0, average 13·6 mm.; hamuli 11–16, average 13·5.

Specimens examined :—Peru : Dept. Cuzco, Marcapata Valley, Madre de Dios, 1000 m., ♀ (*Garlepp*) (B.); Rio Piohis, Porto Bermudez, 12–19.vii.1920, ♀ (C.); Col Perene, El Campamiento, 22–4.vi.1920, ♂ (C.). Bolivia : Dept. Sta. Cruz, Buenavista, 450 m., ♀ (J.B.); Coroico, 2 ♀ (B.). B.W.I., Trinidad : 13.i.1929, ♀ (*J. G. Myers*) (J.B.). British Guiana : ♀ (P. Cameron coll., B.M.) [type of *Megacanthopus rotundicollis* Cam.]; Blairmont, 17.viii.1923, ♀ (*H. E. Box*) (B.M.). Brazil : Bahia, 20.ix.1923, ♀ (*G. L. R. Hancock*) (O.W.R.); Matto Grosso, Corumba, Arnoum, 22–29.xii.1919, ♂ (C.); Minas Gerães, ♀ (*Fruhstorfer*) (B.); 30 miles from Bella Vista, Morro Velho, viii.1935, ♀ (*A. J. Musgrave*) (O.W.R.); Bello Horizonte, 1–6.xi.1919, 2 ♀ (C.); Espirito Santo, 1934, ♀ (*Harttig*) (B.); Rio de Janeiro, ♀ (F. Smith coll.) (B.M.); x.1918, 2 ♀ (C.); Serra Itatiaya, 6.v.1932, 20 ♀ (*J. Zikán*) (D.E.I.); Petropolis, bottom of serra, 27.vii.1923, ♀ (*H. B. Cott*) (B.M.); Lagoinha, 4–5.vii.1923, ♂, 2 ♀ (*W. S. Bristowe*) (O.W.R.); São Paulo, ♀ (Hammer coll.) (C.); east of S. Paulo, Franco, ♀ (*O. Dreyer*) (B.M.); Guaruja, Ilha Santo Amaro, 30.iii.–29.iv.1912, ♀, 4 ♂ (*G. E. Bryant*) (B.M.); Sto. Amaro, ix.–xi.1921, ♀ (J.B.); no precise locality, ♂ (*Urmond*) (B.). Paraguay : Alto Parana, Puerto Bertoni, ♂, 4 ♀ (*Bertoni*), ♀, i.1909 (B.M.), ♀ (J.B.), ♀ (B.), ♂ 4.viii., ♀, 16.vii.1909 (coll. Konow) (D.E.I.); Asuncion, Villa Morra, i., vii., x., xii. (mostly), 11 ♀ (*J. D. Anisits*) (B.), 4.i.1905 and 11.xii.1904, 3 ♀ (*J. D. Anisits*) (B.); Villa Rica, 2 ♂, 4 ♀ (*F. Schade*) (J.B.); no precise locality, ♀ (*Bertoni*) (B.M.). Uruguay: ♀ (*Drake*) (B.). Argentina : Iguaru Falls, 20–22.vi., ♀ (C.); Missiones, Pasadas, 15–24.i.1920, 2 ♀ (C.).

Judging from the description of *M. gracilis* Zikán and from the distribution of the present species, the two are certainly the same. *M. rotundicollis* (Cam.) is most closely related to *M. drewseni* Sauss. but differs, apart from colour, in the somewhat longer abdominal petiole, with more outstanding spiracles and erect pubescence beneath.

I have examined two nests (Plate 1, fig. 136; Plate 2, fig. 141) of *M. rotundicollis*. No. 403, Brazil : Petropolis, serra, 27.vii.1923 (*H. Cott*) (B.M.). No. 417, Peru : Cuzco, Marcapata Valley, Nbfl. d. Madre de Dios, 1000 m., 1900 (*Garlepp*) (B.).

No. 403 was found hanging from the roof of a cottage at the bottom of the Serra. The paper is light yellowish-grey with narrow blackish transverse stripes near distal end of four cells and a similar patch forming bottom of two others. The paper was not varnished but the light part was made of dry wood or plant stems, whereas the dark material was probably very rotten wood. Many of the fragments were rather long and narrow and resembled bits of a dry monocotyledonous leaf. The petiole was 18·0 mm. long (perhaps a little broken), 0·3–0·7 mm. wide, somewhat flattened and twisted, shining dark brown, covered with a hard varnish. The 2·0–3·0 mm. nearest to the point of attach-

ment form a small conical expansion, also thinly varnished. There are 14 cells, the completed ones forming a direct prolongation of the central petiole, the others forming a pretty regular spiral round them, decreasing in size. It is not difficult to make out the order in which they must have been constructed (fig. 136). Completed cells are 21·0 × 4·0 mm. and broaden a little distally. Eggs are laid in new cells when only 3·0–4·0 mm. long, thus near the bottom of the cell. New cells are begun as pocket-like structures on the outside of older ones; at the beginning they are therefore crescentic in section. The cocoon cap forms a nearly hemispherical dome attached just inside the mouth of the cell and projecting 2·0 mm. beyond it. It is made of white silk with about half its surface obscured with patches of paper. Cells 1–2 contained young females with their heads just poking through the cocoon. Cells 3–7 contained larvae and a number of the remainder eggs. These, so far as can be seen in dried specimens, are attached by one end and hang into the cell (no egg-stalk) from a point 3·0–5·0 mm. from the bottom of the cell.

The second nest (Peru) is a small one of about 12 cells, none longer than 8·0 mm. It is reddish-brown in colour, composed of wood particles of two colours, reddish and greyish, evenly mixed. The petiole is 20·0 × 0·5 mm., somewhat twisted but nearly circular, broadening into a narrow cone at each end. The petiole is perhaps made of small root-fragments gummed together unaltered. The nest was attached to a root.

Bertoni (1911 : 126) records that what is probably this species commonly attaches its nest to the spines of orange-trees in Paraguay. He notes that the petiole and part of the object to which it is attached are covered with a brilliant black varnish. Zikán (1935 : 158–9) describes nests (as *M. gracilis*) from near Rio de Janeiro and from Paraguay and states that they are indistinguishable from those of *M. drewseni*. Bristowe (1925 : 479, pl. 47, fig. 2) figures the nest (as *M. labiatus*, but his specimens have been examined) and states that near Rio it is hung from rock-ledges or overhanging banks, usually not near houses.

Mischocyttarus lindigi sp. n.

♀. Very dark brown, nearly black; narrow posterior margin of pronotum and the femora somewhat lighter; antennae 3–12 light red-brown. Tegulae light brown. Wings pale, yellowish tinged, especially towards the costa. Pubescence short and not very dense, that beneath the abdominal petiole hardly at all outstanding; abdomen distinctly shining, pubescence relatively sparse, as in the most shining specimens of *M. melanarius* (Cam.). Length (H. + Th. + T1 + T2) 13·5 mm.

Resembles *M. melanarius* (Cam.) except in the following particulars :—Pronotal keel strong throughout (not markedly stronger in centre as in *M. tomentosus* Zikán), stronger than *M. labiatus* (Fab.); dorso-lateral margin of valve-plate of propodeum acute; mid tarsi with segment 3 little asymmetrical; hind tarsi with inner lobe of segment 3 not much longer than outer lobe of segment 4 (but longer than in *M. drewseni* Sauss., etc.); length of fore-wing 15·0 mm.; hamuli 21; abdominal petiole moderately long (about as long as hind femur + trochanter), distal half broader than usual in this group, posterior margin at least twice as broad as anterior, spiracles moderately projecting.

♂. Unknown.

Type, Colombia : Bogota, ♀ (*Lindig*) (B.).

Mischocyttarus gynandromorphus sp. n.

♀. Blackish-brown, with slight reddish tint on more ventral parts of thorax; tip of abdominal petiole and rest of abdomen light reddish-brown. Tegulae red-brown or dark brown. Wings light brown with yellow tinge. Head and thorax with rather dense pale

pubescence which is longer and more outstanding than in the other species of the group, especially on clypeus and propodeum; abdominal petiole with long, quite dense outstanding pubescence at sides and beneath; rest of abdomen with dense microscopic pubescence. Length (H. + Th. + T1 + T2) 13·0 mm.

Resembles *M. melanarius* (Cam.) except in the following particulars:—ventral part of clypeus hardly more shining though with some large punctures, ventral margin regularly rounded, hardly at all angular (almost as in male of other species but a little more produced), with a minute central truncation or excision, outstanding pubescence also almost as in a male; occiput perhaps a little narrower. Pronotum with a moderately strong and sharp, hardly interrupted, straight keel; dorso-lateral margin of valve-plate of propodeum obtuse (6 spec.) or subacute (2 spec.); mid tarsi with segment 3 little asymmetrical; hind tarsi with inner lobe of segment 3 not longer than outer lobe of segment 4, which is two-thirds as long as its inner lobe; length of fore-wing 15·5–18·0, average 16·13 mm.; hamuli 14–17, average 15·13; abdominal petiole about as in *M. rotundicollis* (Cam.) but spiracles rather distinctly projecting.

♂. Differs from female in same way as the corresponding sexes of *M. rotundicollis* (Cam.), which species it most resembles; differs especially in stronger pronotal keel and longer pubescence, especially on petiole. Length (H. + Th. + T1 + T2) 12·0 mm.

Valve-plates of propodeum with dorso-lateral margin obtuse; length of fore-wings 15·0, 16·0 mm.; hamuli 13, 15.

Type, Peru: Piches and Perene Valleys, 2000–3000 ft., ♀ (*Soc. Geog. de Lima*) (J.B.). Allotype, Brazil: Matto Grosso, Corumba, 14–23.xii.1919, ♂ (C.). Paratypes, Peru: same data as type, ♀ (J.B.); Cam. del Pichis, Tambo Eneñas, 5.vii.1920, ♀ (C.). Brazil: Matto Grosso, Corumba, 14–23.xii.1919, ♀ (J.B.), ♂♀ (C.).

Group of *M. flavicans* (Fab.) (text-figs. 19–26).

Characters of the adults given in the key (p. 306). The ♂ genitalia have been examined in *M. flavicans* (Fab.). The volsellar plate (fig. 26) is of the type found in subgenus *Kappa* Sauss., with a long finger-shaped membranous digitus. The aedeagus ventrally with about 17 teeth, ending a short distance posteriorly to the strong rounded ventral hook.

Larva. The larva of *M. carbonarius* (Sauss.) has been described by Reid (1942 : 323, figs. 178–9, 130). It is especially characterised by having three ventral lobes on the first abdominal segment.

Nest. The petiole is short and attached to one edge of the comb. The cells are unusually large (20 mm. long) in conformity with the size of the adult. The comb always seems to be very irregular (*i.e.* cells of very varying length), perhaps reflecting some peculiarity in the oviposition-cycle of the ♀.

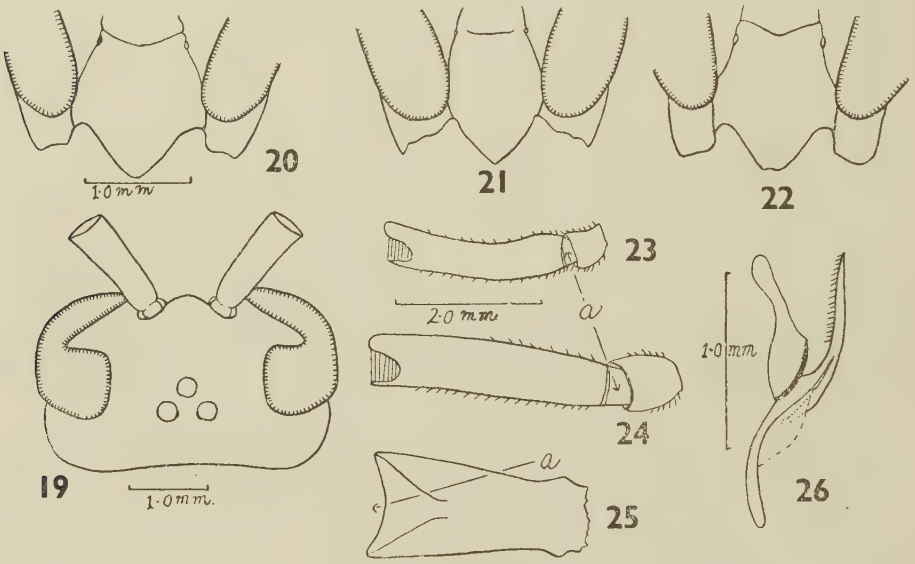
Mischocyttarus flavicans (Fab.).

Polistes flavicans Fabricius [1805] : 276.
Megacanthopus goeldii Ducke, 1906 : 690.

♀. Colour pattern described under the varieties. Length (H. + Th. + T1 + T2) 12·0–14·0 mm.

Head dull (owing to pubescence), not perceptibly sculptured, except for feeble punctures from which bristles arise on the shining clypeus. Mandibles moderately shining, with rather sparse large punctures, proximal ventral third flattened and sharp-edged, beyond this convex, four distal teeth. Malar space at narrowest as long as three-quarters of width of antennal socket. Width of clypeus at its narrowest three-quarters of its length, a lightly impressed central furrow over ventral half, ventral margin very strongly triangularly

produced over nearly its whole width (produced part at least three-quarters as long as broad), actual tip of produced part feebly bidentate. Tentorial pits about equidistant from eyes and from antennal sockets, well removed from both. Antennal sockets about as far from one another as one is from eyes. Antennal segment 3 a little longer than 1 or equal to it in length. Eyes hardly closer ventrally than dorsally, in contact with clypeus for a moderate distance. Ocelli of moderate size, in an equilateral triangle, separated from one another by rather less than the diameter of one, POL : OOL = 1 : 4 (or 5). Occiput not margined, its width behind eyes dorsally nearly four times the POL. Tempora three-quarters width of eye. Thorax + propodeum about twice as long as broad, dull (owing to pubescence which is much more obvious dorsally), unsculptured. Pronotum with anterior margin a little raised, hardly reflexed, not preceded by a furrow; lateral fovea present;



Figs. 19–26.

Fig. 19. Dorsal view of head, *M. flavicans* (Fab.) ♀.
20. Part of head with clypeus, *M. flavicans* (Fab.) ♀.
21. The same, *M. flavicans* var. *coroico* var. n. ♀.
22. The same, *M. carbonarius* (Sauss.) ♀.
23. Ventral view of right fore femur, *M. carbonarius* (Sauss.) ♀. a. Proximal ring.
24. The same of the mid femur.
25. Ventral view of posterior part of sternite 1, showing membranous emargination (a), *M. flavicans* (Fab.) ♀.
26. Ventral view of right volsellar plate, *M. flavicans* (Fab.) ♂.

keel strong and sharp throughout, a little stronger in centre (as in *M. tomentosus* Zikán), straight in dorsal view, rather strong curved in anterior view (owing to convexity of pronotum). Proepisternum only margined along anterior half of sides, anterior margin little raised, not reflexed. Upper division of metapleuron acutely produced along meso-metapleural suture. Postscutellum flattened, almost in same plane as the strongly convex scutellum. Propodeum with its anterior region hardly at all horizontal, with a moderately deep and narrow but rather poorly defined central furrow ending one-fifth of its length from postscutellum, no central keel. Mid tibia with two spurs of equal length, mid tarsi with segment 3 strongly asymmetrical. Hind tarsi with inner lobe of segment 3 a little longer than outer lobe of segment 4 which is about half as long as its inner lobe, claws moderately asymmetrical, larger claw a little sharp. Abdominal petiole not quite as long

as hind femur, parallel-sided to spiracles, sides then diverging in straight lines, posterior nearly three times as broad as anterior margin, spiracles moderately projecting, spiracular ratio 2 : 3, membranous emargination of sternite four times as broad as deep. Tergite 2 moderately expanded, a little longer than broad.

♂. Resembles ♀ except :—Length (H. + Th. + T1 + T2) 12·0 mm. Mandibles less punctured; with four distal teeth; malar space between one-half and two-thirds as long as width of antennal socket; clypeus relatively a little longer, no central impression, ventral margin regularly rounded over nearly its whole width; tentorial pits twice as close to eyes as to antennal sockets; antennal segment 3 much longer than 1 + 2, about as long as 4 + 5 + 6, six times as long as broad, 4–12 gradually decreasing in length, 8 the thickest, 4 one and a half times, 12 one and a quarter times as long as broad, 13 three and a half times as long as broad, nearly as long as 11 + 12, 7–12 each a little curved, but antennae hardly spirally rolled, no segment ciliate, 3–13 with a broad darker more shining ventral area; eyes more approximated ventrally, in contact with clypeus for a longer distance; tempora half width of eye. Posterior spur of mid tibiae about half as long as anterior one. Abdominal petiole less expanded distally, posterior margin only twice width of anterior; sternites 3–6 with white, somewhat recurved, membranous margins.

Mischocyttarus flavicans var. *flavicans* (Fab.).

♀. Testaceous yellow; mandibular teeth, very narrow ventral margin of clypeus, palpi, sometimes two longitudinal marks in front of ocelli, ventral occipital mark, transverse mark in front of and three-quarters as wide as pronotal keel, longitudinal marks on postero-dorsal lobes of pronotum, very narrow anterior margin and indeterminate central line on mesonotum, small discal mark on scutellum, very narrow posterior margin of postscutellum, usually large mark just inside propodeal spiracles, bottom of propodeal furrow, small spot at postero-ventral corner of metapleuron, lobes of fore tarsi indeterminately, segments of mid and hind tarsi (more or less) dorsally, indeterminate mark on distal half of abdominal petiole (except posterior fifth), most of anterior two-thirds of tergite 2, tergites 3–6 except narrow posterior margin of 3, sternites 3–6, *black*. Tegulae testaceous yellow. Wings yellow-brown, especially along costa. Surface of head, thorax and abdomen with dense microscopic yellow pubescence and sparse outstanding blackish bristles; bristles shorter and more numerous on legs; abdominal petiole with quite long and numerous outstanding bristles on all surfaces, remaining sternites with similar but more numerous bristles, which become dense on 4–6. Abdomen dorsally shining. Dorso-lateral margin of valve-plate of propodeum obtuse (3 spec.), subacute (4 spec.) or acute (1 spec.). Length of fore-wing 15·5–17·0, average 14·2 mm.; hamuli 12–16, average 13·6.

♂. Resembles ♀ except :—ventral margin of clypeus concolorous; mid and hind tarsi with segments 2–4 rather sharply black, others testaceous; bristles on abdomen less obvious, pubescence of sternites 2–3 recumbent, becoming progressively denser and more outstanding on sternites 4–7. Dorso-lateral margin of valve-plate of propodeum subacute. Length of fore-wing 14·5 mm.; hamuli 14. Genitalia (fig. 26).

Specimens examined :—Peru : Maranon distr., Mishuyacu, ♀ (B.); Rio Pachitea, ♀ (*Tessmann*) (B.). British Guiana : Essequibo R., Mazaruni Settlement, high forest, 16.viii.1937, ♀ (*Richards and Smart*) (B.M.); Cuyuni R., 3 miles above Kartabo, high forest, 20.ix.1937, ♂♀ (*Richards and Smart*) (♂ B.M., ♀ O.W.R.). Dutch Guiana : ♀ (*Gordon*) (B.), ♀ (D.E.I.). Brazil : Amazons, Teffé, 29.vi.1906, ♀ (*A. Ducke*) (B.M.); S. Antonio do Icá, 7.ix.1906, ♀ (*A. Ducke*) (B.).

Mischocyttarus flavicans var. **coroico** var. n.

♀. Resembles var. *flavicans* except in the following particulars :—occipital mark red-brown; dark marks of thorax all brown or red-brown, mesonotum brown with two yellow

discal stripes, dark mark on scutellum much larger; prepectus ventrally and mesopleuron except for an irregular transverse central mark, yellow-brown; postscutellum and two stripes on propodeum conspicuously pale yellow; legs testaceous; femora and tibiae distally marked with pale yellow, none of tarsi black; abdomen with tergites 1–4 velvety black (much duller and more closer pubescent than in var. *flavicans*) with rather narrow posterior yellow bands; tergites 5–6 and sternites testaceous. All pubescence pale, even bristles pale reddish. Length (H. + Th. + T1 + T2) 12·0–14·0 mm. Clypeus distally pointed, not bidentate. Furrow of propodeum clearly ceasing one-third of its length from postscutellum. Claws of hind tarsi more asymmetrical. Dorso-lateral margin of valve-plate of propodeum acute. Length of fore-wing 15·5, 17·0 mm.; hamuli 11, 13. Abdominal petiole rather less expanded posteriorly.

Type, Bolivia: Coroico, ♀ (B.); paratype, Chaco, ♀ (D.E.I.).

Ducke (1906 : 690) (as *Megacanthopus goeldii* Ducke) briefly describes the nest. In (1907 : 39, pl. 2, fig. 4) (as *M. goeldii*) he figures a nest from the Upper Amazons. The petiole is very eccentric and attached to the underside of a leaf. The comb is very irregular owing to variation in the degree of completion of the cells. He notes the close resemblance in colour of the adult to *Gymnopolybia testacea* (Fab.) (*flavicans* of Ducke, 1907).

Mischocyttarus carbonarius (Sauss.).

Polybia carbonaria Saussure, [1854] : 198.

♀. Black with the following parts more or less suffused with *dirty, yellow-brown*:—mandibles, clypeus, inner and outer orbits, spot in front of median ocellus, spot at top of prepectus (often whitish-yellow), axillae of scutellum, anterior margins of scutellum and postscutellum, sometimes distal marks on mid and hind femora; antennal segments 4–12 and 1–3 beneath, fore tibiae antero-ventrally, posterior distal mark on hind tibiae, *ferruginous*. Fifth segment of fore tarsi *dirty white*. Tegulae black. Wings hyaline suffused with yellow-brown, especially along the costa. Surface of head, thorax and legs with dense microscopic dark brown pubescence and rather sparse outstanding red-brown bristles; abdomen shining but with essentially similar pubescence and bristles; petiole with quite long and numerous outstanding bristles on all surfaces, remaining sternites with similar but more numerous bristles, which become dense on 4–6. Length (H. + Th. + T1 + T2) 13·0–14·0 mm.

Structurally similar to *M. flavicans* (Fab.) except in the following particulars:—produced part of clypeus more truncate, and therefore its weakly bidentate character is more evident; propodeal furrow a little sharper and deeper; dorso-lateral margin of valve-plate of propodeum obtuse (4 spec.), subacute (6 spec.); length of fore-wing 14·0–17·0, average 16·2 mm.; hamuli 10–14, average 11·9.

♂. Not seen.

Specimens examined:—British Guiana, Potaro R., high forest between Kaieteur Savannah and Tukeit, nest 188, 4.ix.1937, 2 ♀, nest 230, 9.ix.1937, 2 ♀, 3.ix.1937, 2 ♀, 6.ix.1937, ♀, 10.ix.1937, ♀ (*Richards and Smart*) (B.M.). Cayenne: ♀ (Paris Mus.). Brazil: Pará, 7.xi.1892, ♀ (*Schulz*) (B.), ♀ (*Bates*) (B.M.).

Some of the Guiana specimens are in my and Dr. J. Bequaert's collections, the remainder in that of the British Museum.

Saussure (1854 : 198) described his *Polybia carbonaria* from "Le Brésil (collection de M. Baly, de Londres)." I have not been able to trace this specimen; it is not in the British Museum, nor at Paris, nor (according to information kindly supplied by Dr. J. Carl) at Geneva. The identification from the description is nevertheless quite satisfactory.

Cameron (1912) described from British Guiana a *Megacanthopus ruficornis* which might be thought to be a synonym of the present species. The type specimen (♀, B.M.) and also a careful study of the original description show that it is the same as *Gymnopolybia angulata* (Fabricius, [1805]) **syn. n.**

Ducke (1907 : 190) notes that a ♂ from Serra de Parintins has the hind tibia and tarsus pale yellow as in *Gymnopolybia angulata* (Fab.) var *angulicollis* (Spin.). This pattern would form a connecting link with that of *M. duckei* (du Buyss.).

The larva of *M. carbonarius* has been described by Reid (1942 : 323) and I have examined two nests (Plate 4, figs. 181–2), no. 188, British Guiana, R. Potaro, Kaieteur–Takeit Trail, 4.ix.1937, underside of mid-rib of leaf of small shrub, 4 ft. from ground. No. 230, same date, underside mid-rib of leaf of Aroid. Both were in native forest of a rather well-illuminated type owing to the steepness of the rocks. No. 188 is light brownish, in parts with a marked reddish tinge. It is made of small pieces of plant-fibre, perhaps mainly plant-tomentum, held together by varnish, moderately shining. There are a certain number of small " windows " where the walls are made of varnish only. The comb consists of four rows of cells—3, 4, 5, 4 = 16. One, to which the petiole is attached, is the end one of the row of five; it is much bigger than the others. The comb seen in side view is conical, one side of the cone being the outer edge of the completed cell, the other being made up of the proximal ends of the other cells. The distal surface of the comb is very irregular. New additions are made at the ends of the rows away from the petiole and new rows are added on one side only. The completed cells are 21·0 × 6·0 mm. The cocoon cap is attached just inside the distal end of the cell, of white silk, apparently nearly flat. The petiole is 7·0 mm. long, circular in section, 1·0 mm. diameter. The varnish is prolonged for 3·0 mm. either way along the mid-rib of the leaf where the petiole is also buttressed for attachment. The nest when taken had one ♀ on it and contained 8 eggs, 1 larva and 1 pupa. Six cells were empty. The pupa later produced a ♀.

Nest 230 consisted of four rows of 3, 4, 4, 3 = 14 cells and the petiole was attached to one of the outer rows. The comb was again very irregular and contained 2 eggs, 7 larvae and 1 pupa. 4 cells were empty.

Mischocyttarus duckei (du Buysson).

Megacanthopus duckei du Buysson, 1908 : 218.
Not *Mischocyttarus duckei* Zikán, 1935 : 196.

♀. Very similar to *M. carbonarius* (Sauss.). Black; clypeus, anterior half of scutellum and postscutellum, two large spots on propodeum, most of mesopleuron, most of legs, abdominal petiole posteriorly above and beneath, *yellow*. Length (H. + Th. + T1 + T2) 11·0 mm. Mesopleuron more shining. Hamuli 11.

Specimen examined :—type, Cayenne : 1909, ♀ (*E. Le Moult*) (Paris Mus.).

The above notes were taken during a hasty examination at the Muséum national, Paris. This form is very close to *M. flavicans* (Fab.) and *M. carbonarius* (Sauss.); in colour, it forms to some extent a connecting link between them.

Subg. *Kappa* Saussure [1854] : 200.

Genotype *Polybia injucunda* Saussure [1854] by designation of Bequaert, 1933.

Although four species-groups are recognised, this subgenus is rather uniform in structure of the adults.

Larva. Reid (1942 : 326) described the larva of *M. injucundus* (Sauss.) which is peculiar in having a single ventral lobe on abdominal segment 1. I have since examined poorly preserved specimens of *M. cassununga* (R. von Iher.), *M. wagneri* (du Buyss.) and *M. angulatus* sp. n. These have two ventral lobes and the first two, at any rate, agree with *M. injucundus* in having coarse bristles on the ventral side of the abdomen.

Nest. It seems impossible to find any subgeneric character in the type of nest constructed.

Group of *M. heliconius* Rich. (text-figs. 27–8).

Characters of adult given in the key (p. 307); male not examined.

Larva. Not examined.

Nest. Two nests of *M. heliconius* Richards (pl. 3, fig. 155) (no. 151, British Guiana : R. Potaro, Tukeit–Kaieteur trail, 1.ix.1937, attached to the mid-rib on the underside of the leaf of *Heliconius* sp. No. 2461, British Guiana : Essequibo R., Moraballi Creek, underside leaf of Aroid over creek, 20.ix.1929) are available. No. 151 is a very small one consisting of two cells, 3·0 mm. long, each with a white egg attached at the bottom. The paper is dark brown, made of irregular wood particles, unfurnished. The petiole is 2·0 mm. long, irregular in shape, thinly varnished. No. 2461 consisted of four cells, two with cocoons, of which the silken cap was entirely covered with paper. These were 15·0 × 4·0 mm. The other two cells had only just been started and contained eggs, 1·0 × 0·5 mm., attached to the sides near the bottom of the cell.

In the Muséum national, Paris, I examined a ♂ of *Megacanthopus undulatus* Ducke, 1905 : 21 (Brazil : Amazons, R. Japura, 16.ix.1904). It seemed to be close to *M. heliconius* Rich. but the occiput was margined and further study might show that it belonged to a distinct group. The following notes on the specimen were made :—♂. Antennal segment 3 much longer than 1 + 2, 11–13 very elongate, spirally rolled, no segment ciliate; occiput strongly margined; anterior margin of proepisternum very little reflexed; abdominal tergite 1 not very long, regularly expanded to posterior margin. Colour almost entirely yellowish with black marks by the ocelli, on the lobes of pronotum, on mesonotum, scutellum, postscutellum and on the posterior surface of the propodeum.

Mischocyttarus heliconius Richards, 1941 : 128.

♀. Colour pattern described under the varieties. Head, thorax and abdomen with rather dense, very short pubescence (considerably less conspicuous than in *M. flavicans* (Fab.)), head and thorax also with rather sparse, not very long, outstanding pubescence, which is longer, denser and more bristle-like on clypeus; tibiae and tarsi with inconspicuous reddish bristles; abdomen entirely dull, petiole with quite dense long outstanding pubescence at sides and beneath, other sternites with shorter but quite distinct outstanding pubescence which becomes dense on sternites 5–6. Length (H. + Th. + T1 + T2) 10·0–10·5 mm.

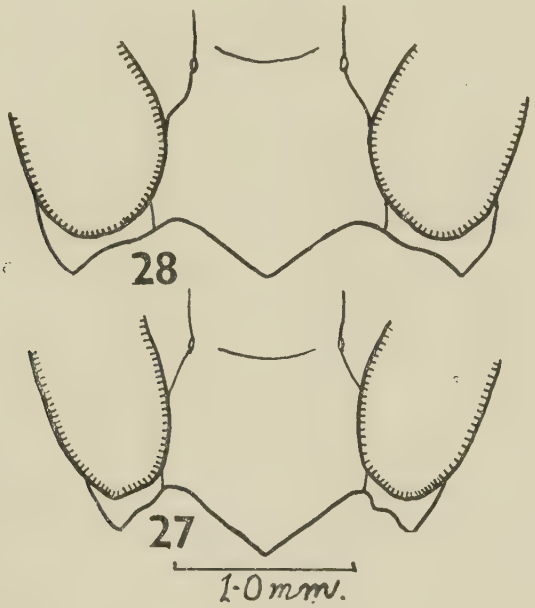
Structurally resembles *M. flavicans* (Fab.) except in the following particulars :—malar space at narrowest between one-quarter and one-third as long as width of antennal socket; clypeus broader, only a little longer than broad, ventral margin less strongly produced, produced part not bidentate; tentorial pits distinctly closer to eyes than to antennal sockets; antennal sockets distinctly farther apart from one another than from eyes; antennal segment 3 as long as 1; hind ocelli separated by one and a quarter diameters, POL : OOL = 1 : 3; width of occiput behind eyes dorsally hardly three times the POL;

tempora hardly more than half width of eye; upper division of metapleuron only subacutely produced along the meso-metapleural suture; propodeal furrow shallower and less well defined; fore coxae with inner proximal articulation reflexed; mid tarsi with segment 3 strongly asymmetrical; hind tarsi with inner lobes of segments 3–4 more produced, inner lobe of 3 much longer than outer lobe of 4, which is two-thirds as long as its inner lobe, claws more asymmetrical; fore and mid femur without ventral sutures cutting off a small proximal piece; abdominal petiole as long as hind femur, parallel-sided to spiracles, thence strongly campanuliform, posterior four times as broad as anterior margin, spiracular ratio 1 : 1, spiracles moderately to weakly projecting.

♂. Not seen.

Mischocyttarus heliconius var. *heliconius* Richards, 1941.

♀. Head black; clypeus (except extreme ventral margin), two small spots between antennae, inner orbits narrowly to posterior limit of eyes, outer orbits narrowly, whitish-



Figs. 27–8.

Fig. 27. Part of head and clypeus, *M. heliconius* Rich. ♀.
28. The same, *M. piger* sp. n. ♀.

yellow; mandibles and antennae testaceous, dorsal margin of former and dorsal side of latter, black (discal patch on mandibles and antennal segment 1 beneath sometimes whitish-yellow). Thorax brownish-black, most of pronotum and propodeum more testaceous; pronotal keel, anterior margin of scutellum and its axillae, anterior margin of postscutellum and its lateral lobes, large patches on each side of black propodeal furrow, spot at top of prepectus, spot at postero-ventral corner of mesopleuron, pale yellow. Fore leg brownish-black, all articulations, tibia beneath, tarsus except proximal two-thirds of segment 1, testaceous, tibia with distal, dorsal yellow spot; mid leg testaceous, coxa with ventral and dorsal black stripes and an external dorsal yellow one, femur with dorsal and ventral black stripes, tibia with a dorsal black stripe and a distal, pale yellow mark; hind leg testaceous, coxa with dorsal black and yellow stripes, trochanter, femur, tibia and proximal two-thirds

of tarsal segment 1 with black dorsal stripe, tibia with a pale yellow distal mark. Abdomen testaceous, indefinite band just before posterior margin of tergite 1, tergite 2 (except anterior third), whole of tergites 3–6 black, narrow posterior band of sternite 2, whole of sternites 3–6, black. Tegulae testaceous. Wings rather distinctly infuscate or (in one specimen) more yellow-tinged, venation yellow-brown.

Dorso-lateral margin of valve-plate of propodeum obtuse (2 spec.) or subacute (1 spec.); length of fore-wing 12·0, 12·5, 12·5 mm.; hamuli 9, 9, 11.

Specimens examined: British Guiana: Essequibo R., Moraballi Creek, high forest, nest 2461, 20.ix.1929, type ♀ (*Oxford Univ. Exped.*) (B.M.), same place, 21.ix.1929, ♀ (*Oxford Univ. Exped.*); Potaro R., trail from Tukeit to Kaieteur Savannah, nest 151, 1.ix.1937, ♀ (*Richards and Smart*) (B.M.). The Moraballi paratype has been deposited in Dr. J. Bequaert's collection. The nests are described on p. 338.

Mischocyttarus heliconius var. **iperuae** var. n.

♀. Yellowish testaceous; ocellar region of occiput, a broader area on the occiput itself (sending a small process to meet eyes), two broad bands from ocelli towards antennae and enclosing a large spot, clouding of postero-dorsal lobes of pronotum, mesonotum (except two yellow central stripes), posterior two-thirds of scutellum and postscutellum, central stripe and antero-lateral marks on propodeum, mesopleural furrows and hollow beneath fore-wing, faint dorsal stripes on fore and mid femora and on hind coxae, *black* or *blackish-brown*. Abdomen dirty yellow (almost brownish) with conspicuous, short, black pubescence, each tergite with a quite distinct, posterior, bright yellow band. Length (H. + Th. + T1 + T2) 10·0 mm.

Otherwise like type *M. heliconius* Richards; dorso-lateral margin valve-plate of propodeum obtuse; length of fore-wing 12·5 mm.; hamuli 10.

Type, British Guiana, Essequibo R., Moraballi Creek, Wallaba (*Iperua* spp., mimoseae) Bush, 19.x.1929, ♀ (*Oxford Univ. Exped.*). In the British Museum collection.

Mischocyttarus piger sp. n.

♀. In colour closely resembles *M. carbonarius* (Sauss.) but darker, pale markings hardly developed. Abdomen considerably duller (also duller than in *M. heliconius*), owing to the denser pubescence. Length (H. + Th. + T1 + T2) 11·5 mm.

Structurally similar to *M. heliconius* Rich. except in the following particulars:—clypeus a little less angularly produced, ventrally quite rounded; malar space hardly longer; POL : OOL nearer 1 : 2; occiput behind the eyes dorsally hardly more than twice the POL; sculpture of the propodeum considerably stronger, more granulate, keel in central furrow stronger, dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 13·5 mm.; hamuli 9; petiole less campanulate, broader anteriorly, less broad posteriorly.

Type, Brazil: ♀ (*Sellow*) (B.).

I was at first quite deceived into regarding this specimen as a variety of *M. carbonarius* (Sauss.), but it clearly belongs to the group of *M. heliconius* Rich. Further material is required to settle whether it is more than a very distinct variety of that species.

Group of *M. ater* (Oliv.) (text-figs. 29–42).

Characters of the adults given in the key (p. 307). The ♂ genitalia have been examined in three species (also in a variety of one of these). They differ from

those of *M. superus* Rich. principally in the long finger-shaped membranous digitus and in the more bristly parameres. The genitalia seem to be little differentiated specifically, though the three species examined were very distinct.

Larva. Only that of *M. injucundus* (Sauss.) has been described (Reid, 1942 : 326, figs. 133–4). It is unique in having only a single lobe on the first abdominal segment. The ventral side of the abdomen bears coarse setae. It will be interesting to see how far other larvae of the group conform.

Nest. The petiole of the comb is usually nearly central and very much flattened. One or two species with aberrant types of nest have the petiole more eccentric. Both *M. ater* (Oliv.) and *M. injucundus* (Sauss.) have been recorded to place drops of honey-like fluid in their cells.

Megacanthopus mocsaryi Ducke, 1909 : 627 (Brazil : Amazons, Obidos) is a species belonging to this group which I cannot place in my key. I examined what was probably a paratype ♂ from Obidos in the Muséum national, Paris, but I did not take sufficient notes on its structure to place it in the present version of my key. In colour, it resembles *M. ater* (Oliv.) but the first abdominal tergite is much longer, and in this and in its sculpture it is closer to *M. tapuya* (Schulz).

Mischocyttarus tolensis Richards, 1941 : 128.

♀. Black; mandibles, ventral half of clypeus, antennae 3–8 beneath, articulations of all legs and fore tibiae anteriorly, *dark ferruginous*; inner orbital streak from clypeus to middle of eye-emargination, antennae segments 9–12 beneath, streak near top of external orbits, transverse mark covering nearly half width of postscutellum, small round spots at top of each valve-plate of propodeum, dorsal surface of segment 5 of front tarsi, antero-dorsal marks on mid and hind coxae, very small distal marks on mid and hind femora, *pale yellow*. Tegulae brown. Wings distinctly fuscous, especially along costa. Surface of head and thorax with rather close, short, semi-recumbent, pale pubescence, longer on ventral third of clypeus; legs and abdomen with dense, microscopic pale, pubescence, legs, tibiae and tarsi also with short, outstanding, reddish bristles; abdominal petiole with dense, outstanding pubescence at sides and beneath, other sternites with similar but shorter pubescence, becoming dense on 4–6. Length (H. + Th. + T1 + T2) 9 mm.

Head dull, vertex with very close, not very fine punctures, supraclypeal plate and dorsal half of clypeus with very fine, close punctures and with sparse larger ones, rest of clypeus smooth and shining, almost unpunctured. Mandibles shining, with sparse, shallow punctures, proximal half flattened and sharp-edged, four distal teeth. Malar space at narrowest about one-quarter width of antennal socket. Width of clypeus at its narrowest one and one-third times its length or rather less, ventral third depressed, rather strongly triangularly produced over its central two-thirds. Tentorial pits a little nearer to the antennal sockets than to eyes. Antennal segment 3 hardly as long as 1. Antennal sockets not quite twice as far from one another as from eyes. Eyes distinctly closer ventrally than on occiput, only just coming into contact with clypeus. Ocelli of moderate size, in a triangle of which the posterior side is distinctly the longest, hind ocelli separated by two and a half diameters, POL : OOL = 2 : 3. Occiput distinctly margined on each side but not or less strongly in the centre, its width behind eyes dorsally not quite twice distance between the posterior ocelli. Tempora rather more than half width of eye. Thorax + propodeum distinctly less than twice as long as broad; pronotum, mesonotum and scutellum very closely and moderately strongly punctured, dull, postscutellum and propodeum more finely punctured, more shining; propodeum with extremely numerous minute punctures and scattered larger ones (especially at sides), separated by at least 3–4 diameters. Mesopleuron very closely, moderately strongly punctured with sparse larger punctures, especially anteriorly, metapleuron more finely punctured, large punctures sparser, mesosternum somewhat shining,

much more finely punctured, the sparse large punctures therefore more distinct. Pronotum with anterior margin moderately raised, little reflexed, preceded by a weak furrow of which the posterior edge is quite obtuse; lateral fovea present or absent; pronotal keel distinct (though not very strong) at sides, interrupted over central third, a little concave anteriorly. Anterior margin of proepisternum strongly raised and reflexed; sides completely and strongly margined. Upper division of metapleuron obtusely or subacutely produced along meso-metapleural suture. Postscutellum flattened but in profile not forming a quite continuous curve with the scutellum. Propodeum with its anterior region almost in same plane as postscutellum, with a deep rather well-defined central furrow, becoming much broader below, separated by one-third its length from postscutellum, without a central keel; dorso-lateral margin of valve-plate of propodeum subacute (1 spec.) or acute (2 spec.). Mid tibia with two spurs of equal length. Mid tarsi with segment 3 strongly asymmetrical. Hind tarsi with inner lobes of segments 3–4 moderately produced, inner lobe of 3 much longer than outer lobe of 4 which is half as long as its inner lobe; claws of hind tarsi only moderately asymmetrical, larger claw a little sharp. Length of fore-wing 8·0, 10·0, 10·0 mm.; hamuli 10, 10, 11. Abdominal petiole hardly as long as hind femur, parallel-sided to spiracles, thence regularly diverging, posterior about two and a half times as broad as anterior margin, spiracular ratio 1 : 1, spiracles extremely little projecting; petiole ventrally flattened throughout, membranous emargination about four times as broad as deep. Tergite 2 strongly expanded, about two-thirds as long as broad.

♂. Not seen.

Specimens examined :—Panama : Tolé, type ♀ (*Champion*) (B.M.); Canal Zone, Barro Colorado Is., 2–3.vii.1924, ♀ (*N. Banks*) (J.B.); Alhajuelo, 8.iv.1911, ♀ (*A. Busck*) (J.B.).

The Barro Colorado paratype is more extensively pale-marked than the type and differs as follows :—whole clypeus ferruginous, antennae black with only segments 9–12 faintly ferruginous beneath; very narrow dorsal posterior margin to the postscutellum, larger spots on propodeum, two dorsal streaks on each hind coxa, rather larger distal mark on all femora, pale yellow. Size a little larger; pronotal fovea present, keel a little stronger; dorso-lateral margin of valve-plate of propodeum acute; hamuli 11; posterior margin of petiole about three times as broad as anterior.

I do not doubt that this is a member of the same species; the pronotal fovea is variable also in *M. injucundus* (Sauss.) of the same group.

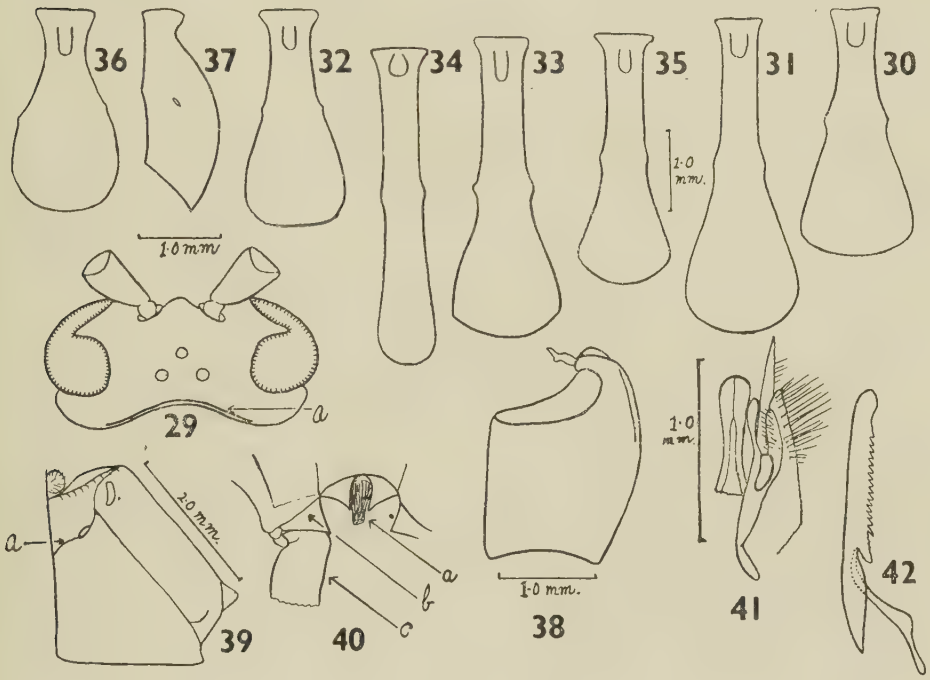
Mischocyttarus fitzgeraldi Bequaert, 1938 : 134.

♀. Black; two lines on vertex, confluent below, antennal segments 1 and 9–12 beneath, *ferruginous*. Fifth segment of fore tarsi dorsally, articulations of all legs and thorax at articulation of hind coxae, *yellowish*. Tegulae black. Wings rather dark fuscous with a small distal white area. Surface of head and thorax with rather close short semi-recumbent pale pubescence, longer on ventral third of clypeus; legs and abdomen with dense microscopic pale pubescence, tibiae and tarsi also with short outstanding reddish bristles; abdominal petiole with dense outstanding pubescence at sides and beneath, other sternites with shorter and sparser pubescence which becomes denser on 4–6. Length (H. + Th. + T1 + T2) 11·0 mm.

Structurally very close to *M. tolensis* Rich. but differs as follows :—malar space a fraction longer; clypeus about as long as broad; ocellar triangle equilateral; occiput more strongly punctured, especially in the centre; thorax a little more strongly punctured, especially postscutellum and dorsal surface of propodeum which resembles mesonotum in being covered with dense not very fine punctures separated by half a diameter; metapleuron with the smaller punctures considerably larger and stronger; pronotal keel quite straight, fovea present; propodeum with its anterior region a little flattened at right angles to post-

scutellum, dorso-lateral margin of valve-plate acute; length of fore-wing 11·5 mm.; hamuli 12; abdominal petiole a little longer and narrower.

♂. Not known.



Figs. 29–42.

Fig. 29. Dorsal view of head, *M. ater* (Oliv.) ♀. a. Margin of occiput.
30. Dorsal view of abdominal tergite 1, *M. tolensis* Rich. ♀.
31. The same, *M. fitzgeraldi* Beq. ♀.
32. The same, *M. frontalis* (Fox) ♀.
33. The same, *M. metathoracicus* (Sauss.) (Lagoinha) ♀.
34. The same, *M. tapuya* (Schulz) ♂.
35. The same, *M. injucundus* (Sauss.) (Oyapock) ♀.
36. The same, *M. ater* (Oliv.) ♀.
37. Left side of abdominal tergite 1, *M. ater* (Oliv.) ♀.
38. Ventral view of left proepisternum, *M. metathoracicus* (Sauss.) ♀.
39. Left metapleuron, *M. metathoracicus* (Sauss.) ♀. a. Ventral process of dorsal division.
40. Valve-plates of propodeum, *M. metathoracicus* (Sauss.) ♀. a. Dorsal muscle of first abdominal tergite. b. Dorso-lateral margin of left valve-plate. c. Left hind coxa.
41. Ventral view of left volsellar plate and distal part of paramere, *M. frontalis* (Fox) var. *anthracinus* var. n. ♂.
42. Aedeagus of *M. injucundus* (Sauss.) ♂, from left.

Specimens examined :—B.W.I., Trinidad : iii.1935, type ♀ (*D. V. FitzGerald*) (B.M.).

FitzGerald (1938 : 183–4) found the nest in the Nariva swamp, Trinidad, 10.iii.1935. It consisted of about 40 cells attached to dry vine and, being composed of dark brown paper, closely resembled a dead leaf. The first fifteen cells formed a comb supported by a petiole at one side. The next eight cells

were arranged in two rows attached to one corner of the fifteen. The remaining cells were in pairs, each attached to the corner of the previous pair. When disturbed, the wasps fell off the nest almost as if dead but checked themselves before touching the ground and flew off. The cap of the cocoon is stained dark [apparently not covered with paper, O.W.R.].

Mischocyttarus latior (Fox).

Polybia latior Fox, 1898 : 451.
? *Mischocyttarus villarricanus* Zikán, 1935 : 200.

♀. Antennal segment 1 (feebly), 3–12 (more in distal segments), fore tibiae anteriorly, *ferruginous*; narrow anterior margin to postscutellum, one dorsal streak on mid, two on hind coxae, small distal mark on all femora, minute spots on thorax at articulations of mid and hind coxae, *pale yellow*; propodeal orifice and parts defining it yellow tinged. Tegulae black. Wings dark fuscous, especially along costa, becoming hyaline distally. Surface of head and thorax with rather close, short semi-recumbent pale pubescence, longer on clypeus ventrally and on propodeum posteriorly; legs and abdomen with very dense sericeous microscopic pubescence, tibiae and tarsi also with short outstanding reddish bristles; abdominal petiole with dense outstanding pubescence at sides and beneath, other sternites with shorter and sparser pubescence which becomes denser on sternites 5–6. Length (H. + Th. + T1 + T2) 11·0 mm.

Structurally very close to *M. tolensis* Rich. but differs as follows :—ventral part of clypeus with more numerous large punctures; malar space at narrowest at least half as long as width of antennal socket; tentorial pits unusually strong; eyes hardly closer ventrally than dorsally; occiput not margined; punctures of propodeum stronger and closer, but finer than in *M. fitzgeraldi* Beq., no larger punctures; pronotal keel quite straight, fovea present; propodeum with its anterior region a little flattened at right angles to postscutellum, dorso-lateral margin of valve-plate acute; length of fore-wing 12·0 mm.; hamuli 12; abdominal petiole a little shorter and broader.

Specimens examined :—Bolivia : Prov. Sara, ♀ (*Steinbach*) (J.B.).

This specimen has been compared with the type of *P. latior* Fox by Dr. J. Bequaert, who also thinks that *M. villarricanus* Zikán is a synonym. This seems quite probable but the specimen I have examined does not agree completely with the description, the petiole being apparently shorter and the thoracic sculpture less strong. *P. latior* was described from Brazil; *M. villarricanus* from Paraguay : Villa Rica.

Zikán (1935 : 200–201, pl. 3, fig. 8) has described the nest from which the types of his *M. villarricanus* were taken. There were 9 open and 5 closed cells, arranged side by side in two rows of 7. The petiole seems to be eccentric and the paper was light brown. Three wasps were sitting on this nest.

Mischocyttarus frontalis (Fox).

Polybia frontalis Fox, 1898 : 454.

Colour-pattern described under the varieties.

♀. Structurally close to *M. tolensis* Rich. but differing as follows :—very little of ventral part of clypeus without fine punctures, rather more produced but mainly over central half; POL : OOL = 3 : 4; occiput hardly perceptibly margined, the margin more ventral and difficult to see, its width behind the eyes dorsally not more than one and a half times distance between posterior ocelli; tempora half width of eyes; thorax + propodeum shorter and broader; thoracic sculpture rather stronger, as in *M. fitzgeraldi* Beq. (particularly as regards propodeum); larger size of puncture much less distinct on meso- and metapleuron. Pronotum with anterior margin preceded by a furrow with posterior margin about rectangular; lateral fovea present; keel considerably stronger than in three preceding species (though

interrupted), distinctly concave anteriorly; central furrow of propodeum broader, less well defined, extending more or less distinctly to propodeum, central keel fairly distinct, valve-plate with dorso-lateral margin acute. Abdominal petiole a little shorter and broader, only just (instead of clearly) longer than hind femur + trochanter.

♂. Differs from ♀ as follows :—Mandibles with three distal teeth; antennae with segment 3 a little longer than 1 + 2 or 4 + 5, 4–10 progressively shorter (8 about the thickest), 4 twice as long as broad, 10 quadrate, 6–10 somewhat flattened beneath, 11–13 becoming longer and thinner, 13 nearly three times as long as broad, as long as 9 + 10, segments 3–7 with a narrow shining longitudinal area, antennae not ciliate, distally subspirally rolled. Occiput behind eyes dorsally as wide as distance between posterior ocelli; tempora one-third width of eye. Genitalia (figs. 41, 42) with the parameres more bristly than in *M. superus* Rich. (fig. 85). Volsellar plate with digitus long finger-shaped, membranous. Aedeagus with 17 teeth beneath.

Mischocyttarus frontalis var. *frontalis* (Fox).

♀. Black; mandibles, anterior aspect of head up to level of top of eye-emargination, antennal segment 1 (except small dorsal mark), 3–12 very feebly beneath, ventral angle of pronotum, *pale ferruginous*. Broad posterior orbits, keel and narrow postero-dorsal margin of pronotum, narrow spot at top of prepectus, anterior half of postscutellum, posterior eighth of tergite 1, fore tibiae anteriorly and a small postero-distal spot, dorsal surface of segment 5 of fore tarsi, dorsal marks on mid and hind coxae, distal marks on mid and hind femora, distal mark on mid tibiae, valve-plates of propodeum, *bright yellow*. Tegulae ferruginous. Wings nearly hyaline. Surface of head and thorax with short close semi-recumbent pale pubescence (yellower on thorax), longer on ventral third of clypeus; legs and abdomen with dense microscopic pale pubescence (on abdomen subsericeous), tibiae and tarsi with short outstanding reddish bristles; abdominal petiole with rather dense but not very long outstanding pubescence at sides and beneath, other sternites with short recumbent pubescence, becoming long and outstanding on sternites 5–6. Length (H. + Th. + T1 + T2) 9·0 mm. Length of fore-wing 8·5 mm.; hamuli 8.

♂. Differs from ♀ as follows :—antennae black, segment 1 almost entirely ferruginous, 7–13 yellow beneath; small spot on mandibles, inner orbits indefinitely, narrower interrupted distal band on petiole, posterior mark on tegulae, *yellow*. All femora, especially front pair, with indications of paler dorsal streak. Clypeal pubescence hardly different, that on sternites 5–7 hardly outstanding. Length of fore-wing 8·5 mm.; hamuli 10.

Specimens examined :—Brazil : Chapada, ♂♀ paratypes (J.B.).

Mischocyttarus frontalis var. **anthracinus** var. n.

♀. Black; mandibles, anterior aspect of head to level of tip of eye-emarginations, antennal segment 1 (except dorsal mark) and 7–12 beneath, broad posterior orbits, pronotal keel and posterior margin, mark at top of prepectus, scutellum considerably, fore tibiae largely, distal margin of abdominal petiole, *dark pitchy red*. Lateral sixth of pronotal keel and very small mark on dorsal side of fifth segment of fore tarsi, *yellow*. Tegulae black. Wings a little darker, especially along costa. Length (H. + Th. + T1 + T2) 10·0 mm.; length of fore-wing 9·5 mm.; hamuli 11.

♂. Resembles ♀ except :—antennae black, except for segment 1, external orbits with yellow streak, posterior margin of pronotum narrowly yellow-tinged, femora narrowly yellow distally. Length of fore-wing 9·0 mm.; hamuli 9. Genitalia apparently not differing from those of var. *frontalis* (Fox).

Paraguay : Alto Parana, Hohenau, type ♀, allotype ♂ (*F. Schade*) (J.B.).

The type is in Dr. J. Bequaert's collection and the allotype has been placed in the British Museum.

Mischocyttarus metathoracicus (Sauss.).

Polybia metathoracica Saussure, [1854] : 198.

♀. Black; inner orbits from clypeus to bottom of eye-emargination, narrow posterior margin to pronotum (at least on central third), scutellum and postscutellum (except axillae and lateral depressions), a quadrate mark on the propodeum and a small spot on its valve-plate, often a narrow posterior border to tergites 1–2 or 3, dorsal surface of fore tarsal segment 5, dorsal and sometimes ventral streak on mid coxae, two (rarely only outer present) dorsal streaks on hind coxae, small distal spot on all femora, distal spot on mid tibiae, *bright yellow*. Antennae with segments 10–12 beneath, and small dorsal, proximal suffusion of hind femora, *ferruginous*. Tegulae black. Wings a little fuscous-tinged, especially along the costa. Surface of head and thorax with close, short, semi-recumbent, white pubescence, longer and more reddish on ventral third of clypeus; legs and abdomen with very dense, microscopic, pale pubescence, tibiae and tarsi also with short, outstanding, reddish bristles; abdominal petiole at sides and beneath with dense, outstanding, pale pubescence, rest of sternites with shorter pubescence which becomes long and outstanding on sternites 4–6. Length (H. + Th. + T1 + T2) 9·5–11·0 mm.

Structurally close to *M. tolensis* Rich. but differs as follows :—only ventral quarter of clypeus without fine punctures; malar space if anything a little shorter; clypeus often a little narrower; occipital margin continuous; postscutellum and propodeum more strongly punctured, propodeum dorsally with close, moderately strong punctures (separated 1–3 diameters), only at the sides with very fine close and large sparse punctures mixed; lateral fovea of pronotum distinct (10 specimens) or very small (1 spec.–Pará), keel a little stronger; postscutellum not at all flattened, in profile not aligned with scutellum; propodeum with central furrow broad, very shallow and ill defined, dorsally separated by half its length from postscutellum with no central keel, anterior region well raised, forming a distinct angle with postscutellum, dorso-lateral margin of valve-plate subacute (10 spec.) or acute (4 spec.) (1 not recorded); length of fore-wing 9·0–11·0, average 10·3 mm.; hamuli 8–11, average 9·4; abdominal petiole sometimes similar, but often rather narrower and less expanded distally, a little longer than hind femur, spiracles sometimes more projecting.

♂. Not seen.

The species is somewhat variable in colour and structure and the following forms may be recognised. More material is required to settle their status.

Mischocyttarus metathoracicus var. *metathoracicus* (Sauss.).

Propodeum with quadrate yellow spot covering half length of posterior face (2 Pará, 1 Tapajos, 1 Iquitos), usually emitting a fine yellow line down centre of furrow, or covering whole posterior face (2 Pará, 1 no loc.), dorso-lateral margin of valve-plate subacute. Posterior margin of pronotum yellow margined throughout (6 spec.) or only along central third (1 Iquitos). Scutellum and postscutellum yellow. Abdomen with tergites 1–2 yellow posteriorly (4 spec.) or 1–3 (1 Pará, 1 no loc.), or entirely black (1 Iquitos). Petiolar spiracles not much projecting, petiole unusually broad in Iquitos specimen; pronotal keel not very strong; length of fore-wing, average 10·0 mm.; hamuli average 9.

Specimens examined :—French Guiana : type ♀ (*Leprieur*, 1839) (Mus. nat., Paris). Brazil : Pará, 27.ii.1902, ♀ (*A. Ducke*) (B.M.), Pará, ♀ (B.M.), Pará, 2 ♀ (*Sieber*) (B.); Tapajos, ♀ (B.M.); Iquitos, 5.viii.1906, ♀ (*A. Ducke*) (B.). No locality : ♀ (Wilson Saunders coll., O.).

Saussure described the species from Cayenne and the above form corresponds more or less closely to his description and to the type.

Mischocyttarus metathoracicus variety.

Propodeum black, or with a yellow spot separated by its own length from postscutellum, or (1 no loc.) similar spot adjacent to postscutellum, or (Cuyuni) whole disc of propodeum

yellow, dorso-lateral margin of valve-plate acute (2 spec.) or subacute (2 spec.). Posterior margin of pronotum entirely or one-third yellow. Scutellum black or with posterior half yellow, postscutellum yellow. Abdomen with tergites 1–2 very indistinctly yellow posteriorly or entirely black. Abdominal petiole and pronotum like var. *metathoracicus*.

Specimens examined :—British Guiana : Georgetown, ♀ (*Sadovnikova*) (B.); Essequibo R., ♀ (*A. Busck*) (J.B.); Cuyuni R., Oko Creek, 29.vi.1931, ♀ no. 503 (*N. A. Weber*) (J.B.). S. America : ♀ (Wilson Saunders coll., O.).

Mischocyttarus metathoracicus variety.

Propodeum black, dorso-lateral margin of valve-plate subacute. Posterior margin of pronotum with only a very small spot yellow. Scutellum and postscutellum yellow. Abdomen black. Coxae almost entirely black. Abdominal petiole rather short and broad, spiracles little projecting; pronotal keel rather strong; central furrow of propodeum unusually deep and well defined. Hamuli 10, wing-length 11·0 mm.

Specimen examined :—E. Bolivia : 1.iii.1907, ♀ (*Steinbach*) (B.).

Mischocyttarus metathoracicus var. *flavoscutellatus* Zikán.

Mischocyttarus flavoscutellatus Zikán, 1935 : 198 **syn. n.**

Propodeum with a transverse dorsal mark which sends a narrow, ventrally pointed, stripe down the furrow, dorso-lateral margin of valve-plate acute. Posterior margin of pronotum narrowly yellow over central half. Scutellum and postscutellum yellow. Abdominal petiole anteriorly somewhat narrower, posteriorly somewhat more suddenly and widely expanded than in the typical form. Abdomen entirely black. Yellow markings more orange. Wing-length 10·5 mm. Hamuli 10.

Specimen examined :—Brazil : Lagoinha, 7.vii.1923, ♀ (*G. L. R. Hancock*) (O.W.R.).

Zikán (1935 : 198) describes this form as a species from Brazil : near Rio de Janeiro, Itatiaya. The above female agrees closely with his description and comes from the same district. Zikán was led to treat *M. flavoscutellatus* as a species because he compared it with a specimen determined as *M. metathoracicus* from Mexico. This is quite outside the range of the species as at present recorded; and there is no certainty he was examining a correctly identified specimen; moreover, even in the small series I have studied, the diagnostic characters he uses show considerable variation.

Mischocyttarus metathoracicus var. *picturatus* Bequaert, 1938 : 135.

Mandibles, head, pronotum, top of prepectus and metapleuron ferruginous, at least mainly. Propodeum with two broad yellow stripes separated by the black furrow, dorso-lateral margin of valve-plate acute. Posterior margin of pronotum entirely yellow. Scutellum black, postscutellum yellow. Abdominal petiole like var. *flavoscutellatus* Zikán, but a little longer and narrower. First three abdominal tergites and second sternite with a pale margin. Length of fore-wing 10·0 mm.; hamuli 9.

Specimen examined :—Brazil : Matto Grosso, Corumba, ♀ paratype (J.B.).

Ducke (1907 : 189) states that on the Amazons the nest resembles that of *M. injucundus* (Sauss.) and has the same tendency for growth in two opposite directions. The petiole is central. He notes (: 187) the resemblance in colour of the adult *Polybia jurinei* Sauss. Zikán (1935 : 198–200) records the history of a nest of the var. *flavoscutellatus* found at Itatiaya, near Rio de Janeiro. It was attached to the midrib on the underside of a Marantaceous leaf, about 1 m. from the ground. When found there were 7 ♀ on it and it was observed over a

considerable period until it was destroyed, probably by a bird. The wasps made a new nest about 2 m. up beneath the large leaf of a Rubiaceous plant; the 7 ♀ were again found on this nest. Before any ♂♂ had been produced, the nest was again destroyed, probably once more by a bird.

Mischocyttarus pseudomimeticus (Schulz).

Polybia pseudomimetica Schulz, 1903 : 803.
Megalocanthopus pseudomimeticus Schulz, 1906 : 234.
Mischocyttarus pseudomimeticus Ducke, 1918 : 350.

♀. Black; inner orbits from clypeus to bottom of eye-emargination, moderately broad postero-dorsal margin to pronotum, two lines on disc of mesonotum, scutellum and post-scutellum (including most of axillae), minute spot at top of prepectus, two broad stripes on propodeum, separated by the black furrow, all parts immediately adjacent to orifice of propodeum, narrow posterior margins to abdominal tergites 1–5 and sternites 2–3, dorsal streaks on mid and hind coxae, small antero-distal spots on mid and hind femora, *pale yellow*. Tegulae testaceous with a large inner yellow area. Wings hyaline with a considerable yellow tinge along costa. Surface of head and thorax with rather close, short, semi-recumbent, pale pubescence, longer on ventral third of clypeus; legs and abdomen with dense, microscopic, pale pubescence, tibiae and tarsi also with short, outstanding, reddish bristles; abdominal petiole with the dense pubescence shorter, long, outstanding pubescence rather sparse. Length (H. + Th. + T1 + T2) 13·0 mm.

Structurally close to *M. tolensis* Rich. but differs as follows :—punctures of head not quite so close, large punctures of clypeus more numerous; malar space about one-third width of antennal socket; POL : OOL = 1 : 2; occiput distinctly margined throughout. Thorax + propodeum distinctly more than twice as long as broad; punctures of propodeum of about same size (size relatively constant) as those of mesonotum and closely placed (separated by less than 1 diam., therefore stronger and closer than in *M. tolensis* Rich. without the scattered large ones). Pronotal keel very considerably stronger, distinctly lamelliform, interrupted over rather less than central third; fovea present. Postscutellum rather more convex. Propodeum with a rather deep, quite well-defined furrow, becoming only a little broader below, stopping about one-fifth its length from postscutellum, no central keel, valve-plate with dorso-lateral margin acute. Length of fore-wing 12·0 mm.; hamuli 10. Abdominal petiole fully as long as hind femur, rather longer than in *M. tolensis* Rich. but of about the same shape; tergite 2 as long as broad.

Specimen examined :—Brazil : Amazons, Iquitos, 13.viii.1906, ♀ (*A. Ducke*) [det. Ducke], Teffé, 1907, ♀ (*A. Ducke*) (Mus. nat., Paris).

Ducke (1918 : 362) suggests that *Polybia traili* Cameron, 1906a : 383 (Amazons) is a synonym of the present species but the type of that species seems to be lost.

Ducke (1907 : 190) mentions a small nest of *M. pseudomimeticus* with the petiole approximately central. He notes (: 187) the resemblance in colour of the adult to *Polybia liliacea* (Fab.).

Mischocyttarus tapuya (Schulz).

Polybia tapuya Schulz, 1905 : 133.
Megalocanthopus tapuya Schulz, 1906 : 234.
Mischocyttarus tapuya Ducke, 1918 : 353.

♂. Black; mandibles (except red teeth and proximal cloudy mark), whole face up to just above antennae, antennal segment 1 beneath, a narrow dorsal streak behind eyes, keel and narrow posterior margin of pronotum, spot at top of prepectus, small spot on scutellar axillae, anterior half of postscutellum and its axillae, large round spots on each side of propodeum ventrally, valve-plates, spot at bottom of mesopleuron just in front of mid

coxae, fore and mid coxae beneath, two dorsal stripes on hind coxae, distal third of fore femora behind, distal third in front and small distal mark in front of mid and hind femora, distal fifth of fore and mid tibiae, minute distal spot on hind tibiae, dorsal surface of segment 5 of fore tarsi, narrow posterior bands on tergites 1–6, sides and ventral surface of petiole for distal quarter, narrow posterior band of tergite 2, *bright yellow*. Antennal segments 2–13 beneath, ventral angle of pronotum, almost whole of metapleuron, fore and mid femora antero-dorsally, small proximal mark on hind femora, all tibiae (more or less) antero-ventrally, *ferruginous*. Tegulae brown. Wings nearly hyaline, a little infuscate. Surface of head and thorax with close, rather short, semi-recumbent, whitish pubescence, hardly longer on clypeus; legs and abdomen with dense, microscopic, pale pubescence, tibiae and tarsi also with short, outstanding, reddish bristles; the petiole beneath strongly shining, outstanding pubescence long but not at all close; other sternites with short, recumbent pubescence, sternites 6 and 7 with an anterior band of long, semi-recumbent, silky pubescence. Length (H. + Th. + T1 + T2) 9·5 mm.

Structurally close to *M. tolensis* Rich.; specific (as distinct from sexual) differences are as follows:—Punctures of head closer and finer; those on clypeus hardly perceptible; malar space at narrowest not quite obliterated; tentorial pits a little closer to eyes than to antennal sockets; POL : OOL = 3 : 4. Occiput finely margined throughout. Pronotum, mesonotum, scutellum and postscutellum with the punctures a little stronger and less close, with trace of sparse, larger and shallower ones; propodeum and metapleuron with extremely large (almost honey-comb-like, much larger than in any allied species) punctures, separated by 0–1 diam. on propodeum, ½–3 diam. on metapleuron, and almost no trace of fine punctures; mesopleuron down to ventral furrow and mesosternum on posterior half with similar large punctures (separated 1–2 diams.). Pronotum with keel a little stronger and sharper, fovea distinct. Upper division of metapleuron obtusely produced along meso-metapleural suture. Propodeum with a short anterior region which is somewhat flattened and forms an angle with the postscutellum, central furrow rather shallow, separated by nearly half its length from postscutellum, central keel distinct, dorso-lateral margin of valve-plate obtuse. Length of fore-wing 8·5 mm.; hamuli 9.

Abdominal petiole much longer than hind femur + trochanter, nearly as long as hind femur + trochanter + coxa, parallel-sided almost throughout, spiracular ratio 5 : 4, spiracles rather strongly projecting; petiole ventrally not very obviously flattened, membranous emargination nearly three times as broad as deep. Tergite 2 strongly expanded, as long as broad.

Sexual characters:—Mandibles with three distal teeth; clypeus ventrally feebly rounded; eyes in contact with clypeus for a considerable distance; antennae with segment 3 considerably longer than 1 + 2, a little longer than 4 + 5, 4–10 progressively shorter (8 about the thickest), 4 two and a quarter, 10 once as long as broad, 6–10 a little flattened beneath, 11–13 becoming longer and thinner, 13 nearly four times as long as broad, as long as 5 or 9 + 10; antennae segments 3–10 with shining, longitudinal areas, not ciliate, distally subspirally rolled. Occiput behind eyes dorsally hardly wider than distance between posterior ocelli; tempora between one-quarter and one-third width of eye.

Specimen examined:—Brazil: Pará (Belem), 22.xii.1893, ♂ type (*W. A. Schulz*) (B.M.).

Mischocyttarus injucundus (Sauss.).

Polybia injucunda Saussure, [1854] : 200.
Mischocyttarus injucundus Ducke, 1918 : 353.

♀. Colour-pattern described under the varieties. Surface of head and thorax with rather close short semi-recumbent pale pubescence, longer on ventral quarter of clypeus; legs and abdomen with dense microscopic pale pubescence, tibiae and tarsi also with short outstanding reddish bristles; abdominal petiole with moderately dense and long out-

standing pale pubescence at sides and beneath, other sternites with shorter pubescence which becomes longer and more outstanding on sternites 4–6. Length (H. + Th. + T1 + T2) 10·0 mm. Only ventral quarter of clypeus smooth and shining; clypeus hardly broader than long; occiput margined in centre or not, its width behind eyes dorsally about one and a half times distance between posterior ocelli; postscutellum punctured like the scutellum but more finely and closely, propodeum punctured like the mesonotum (without scattered larger punctures), punctures separated by ½–1 diameters; pronotum with lateral fovea present (25 spec.) or not (1 spec.), keel moderately strong (a little stronger than *M. tolensis* Rich., weaker than in *M. metathoracicus* (Sauss.), distinctly interrupted over central third, laterally rather lobate and ending rather abruptly; propodeum with a distinct flattened anterior region forming an angle with postscutellum (almost as conspicuous as in *M. metathoracicus* (Sauss.)), central furrow moderately deep and well defined, separated by one-third of its length from postscutellum, narrow above, broadening strongly quite ventrally (so that its shape is trifoliate), no central keel but ventral part of bottom of furrow smooth and shining or cross-striate, dorso-lateral margin of valve-plate acute; abdominal petiole nearly as long as hind femur + trochanter, parallel-sided to spiracles, thence diverging rather strongly, posterior fully two and a half times as broad as anterior margin, spiracles a little more projecting, spiracular ratio rather less than 1 : 1; tergite 2 as long as broad.

♂. Differs from ♀ as follows :—sternites 4–7 with rather dense outstanding pubescence (denser on 6–7); clypeus and to less extent vertex with dense short appressed silvery pubescence; mandibles broader, with three distal teeth; clypeus hardly broader than long, ventrally gently rounded; eyes in contact with clypeus for a somewhat longer distance; tentorial pits twice as close to eyes as to antennal sockets; antennae with segment 3 much longer than 1 + 2, hardly as long as 4 + 5, 4–10 progressively shorter (8 about the thickest), 4 two and a quarter, 10 about once as long as broad, 6–10 a little flattened, 11–13 becoming longer and thinner, 13 four times as long as broad, as long as 4, antennae not ciliate, segments 3–10 with shining longitudinal areas which on more distal segments cover whole ventral surface, distally antennae subspirally rolled; occiput completely margined dorsally, its width behind eyes dorsally equal to distance between posterior ocelli; tempora one-third width of eye. The genitalia could not be distinguished from those of *M. frontalis* (Fox) except that the aedeagus in the specimen examined had 15 teeth beneath.

Mischocyttarus injucundus var. *injucundus* (Sauss.).

♀. Black; inner orbits from clypeus to bottom of eye-emargination, narrow posterior border of pronotum, anterior third of postscutellum, a spot (usually large) on each side at bottom of posterior face of propodeum, spots on plates surrounding orifice of dorsal muscle and on valve-plates, dorsal surface of segment 5 of fore tarsi, small dorsal, distal mark on all femora, small distal marks on mid and hind tibiae, small antero-dorsal streak on mid coxa, two dorsal streaks on hind coxa, *pale yellow*. Tip of mandibles, sometimes two discal marks on clypeus, antennae 3–12 beneath (more or less), ventral angle of pronotum, dorsal spot on prepectus, posterior angles of mesosternum and metapleuron, a more or less distinct suffusion in centre of metapleuron, parts round orifice of propodeum, articulations of legs, abdomen (except sometimes irregular black markings) *ferruginous*. Tegulae testaceous. Wings little yellow-brown tinged proximally and only slightly fuscous beyond pterostigma. Length of fore-wing 8·0–10·5, average 9·1 mm.; hamuli 8–11, average 9·1.

♂. Similar. Length of fore-wing, 8·0, 8·5 mm.; hamuli 8, 9.

Specimens examined :—Brazil : Pará, 24.iii.1899, ♂♀ (*W. A. Churchill*) (B.M.), Pará, ♀ (B.M.); Oyapock, 18.vi.1904, ♀ (*A. Ducke*) (B.M.); Marajo, Para Soure, 2 ♀ (*O. Bertram*) (B.); Faro, 3.ix.1907, ♂ (*A. Ducke*) (B.M.) (var. with two red spots on clypeus); Bahia, ♀ (*Freireyes*) (B.); Rio Machados, ♀ (D.E.I.); no locality, ♀ (B.M.).

The type of the species which was described from Pará (coll. Spinola) presumably belongs to this variety, though Saussure does not mention the spots on the propodeum. The variety seems to be found chiefly in Amazonia, but the record from Bahia suggests that it may occur through much of N.E. Brazil.

Mischocyttarus injucundus var. *bimarginatus* (Cam.).

Polybia bimarginata Cameron, 1912 : 211.

♀. Yellow spots on propodeum very small or absent; distal extremities of mid and hind tibiae black or with extremely little yellow; wings strongly yellow-brown tinged proximally and fuscous tinged distally. Length of fore-wing 8·0–10·0, average 9·0 mm.; hamuli 8–10, average 9·3.

♂. Similar. Length of fore-wing 9·5 mm.; hamuli 9.

Specimens examined :—British Guiana : 2 ♀ (P. Cameron coll.) (B.M.) [both marked types of *Polybia bimarginata* Cam.; both with propodeal spots larger than usual]; Berbice, x.1922, ♀ (*M. D. Haviland*) (B.M.) (var. with two red spots on clypeus); Blairmont, 12.ix.1923, ♀ (*H. E. Box*) (B.M.); Essequibo R., Monkey Jump, 5.x.1929, ♀ nest 3626 (*Oxford Univ. Exped.*) (B.M.) [no fovea]; Mazaruni Settlement, clearing, 28.viii.1937, ♀ nest 127 (var. with propodeal spots larger), 18.ix.1937, ♀ nest 138, 27.viii.1937, 3 ♀ nest 116 (*Richards and Smart*) (B.M.); North-West District, Issororo, 14.xii.1913, ♂ (*G. E. Bodkin*) (Brit. Guiana, Dept. Agric.); " Demerary," ♀ (B.). Cayenne : ♀ (*Lacordaire*) (B.) (var. with propodeal spots larger). Brazil : S. Antonio do Icá, 15.ix.1906, ♀ (*A. Ducke*) (B.).

Mischocyttarus injucundus var. *bertonii* Ducke.

Mischocyttarus injucundus var. *bertonii* Ducke, 1918 : 371.

♀. Mandibles, two clypeal spots confluent ventrally or most of clypeus, antennal segments 1 and 9–12 beneath, outer orbits, sometimes scutellum, *ferruginous*. Sometimes inner orbits, spot at tip of prepectus, whole postscutellum, two large spots on each side of and extending nearly whole length of propodeal furrow, narrow posterior margin to abdominal petiole (above and sometimes beneath) and to tergite and sternite 2 (latter often interrupted), *pale yellow*. Distal extremity of mid and hind tibiae externally also pale yellow. Wings nearly hyaline. Length of fore-wing 9·0–9·5, average 9·3 mm.; hamuli 9–11, average 9·8.

Specimens examined :—Paraguay : Alto Parana, Pto. Bertoni, ♀ paratype (*Bertoni*) (J.B.); Villa Rica, 4 ♀ (*F. Schade*) (J.B.).

Ducke (1905 : 688, pl. 4, fig. 22) describes and figures the nest of the typical variety. It has a comb of about 30 cells, arranged in three irregular rows. The petiole is approximately central, and growth is principally at two opposite ends. He notes (1907 : 37) the colour-resemblance of the adult to *Polybia rejecta* (Fab.). FitzGerald (1938 : 183–4) found the species fairly frequent in Trinidad in well-wooded gardens or among vegetation. He states that it builds a more or less rectangular comb supported by an eccentric pillar. Sometimes a drop of clear honey-like liquid was found in a cell otherwise empty or containing an egg. The largest examined contained 69 cells. The paper is brittle and dark-coloured, and since the wasp is dark reddish-brown, the colony is comparatively inconspicuous. It exactly resembles the extremely aggressive *Polybia rejecta* (Fab.). R. von Ihering (1904 : 250) also describes a nest.

Zikán (1935 : 168) states that nests of *M. injucundus* are reddish-brown in colour, have a flattened petiole and are attached beneath leaves but not to the mid-rib.

I have examined four nests of the var. *bimarginatus* (Cam.) (pl. 1, figs. 134–5; pl. 4, figs. 183–4). No. 3626 was found by Mr. J. E. Duffield attached to the underside of the mid-rib of a leaf, British Guiana: Essequibo R., Monkey Jump, 5.x.1929. The paper is red-brown, made of flat, largely oval, wood-particles, very thinly varnished except on the petiole, which is 3·5 mm. long, 1·0–2·0 mm. broad, flattened parallel to the mid-rib to which it is attached by small buttresses and a plate of attachment 6·0 × 2·0 mm. There is also a rather large cone of attachment at the comb, which consists of 3 rows of 3, 4, 3 = 10 cells. The two central cells of the mid-row are complete, 12·5 × 4·0 mm. and the petiole is attached to one of them; the other cells are about half-finished. The cocoon-cap is brown, of coarse fibrous dull silk, flat and about on the level with the top of the cell.

Three other nests, British Guiana: Mazaruni Settlement, clearing, no. 116, 27.viii., no. 138, 18.ix., no. 127, 28.viii.1937, were all found on one Mango tree, near Colony House. This tree was covered with runs of an enormous colony of the ant *Dolichoderus* (*Hypoclinea*) *bidens* (L.) (det. H. St. J. K. Donisthorpe). There were also more than a dozen nests of the wasp *Polybia rejecta* (Fab.). It was a striking fact that only on this one tree were nests of either *P. rejecta* or *M. injucundus* found during the two months of our stay. The three nests were each attached to the upper side of the mid-rib of a mango-leaf. The largest, no. 116, was light brownish-grey, made of numerous small wood particles with a moderate number of rather elongate fragments (? of monocotyledonous leaf or stem) plastered on. The whole thinly varnished and a little shining. The petiole was 4·0 mm. long, 2·5 × 1·0 mm. in section, flattened at right angles to the long axis of the nest. For more than half its length the petiole broadens into a relatively large cone to which the nest was attached, while at the leaf it was attached by a thin plate of varnish and buttresses. Petiole attached to centre of comb which consisted of 7, 8, 8 = 23 cells. The completed cells were in the centre of each row and the new ones were pocket-like structures at the ends of the rows, the distal surface of the comb being in consequence very convex. The completed cells were 11·0 × 3·5 mm. and the cocoon caps were attached just inside the end of the cell, composed of dark brown semi-transparent silk in which a good many distinct fibres could be seen. When taken, the nest had two females on it, 6 pupae, 7 larvae, 8 eggs and two empty cells. Nest 138 was a similar but much smaller nest of 4 cells, none more than half complete but each containing an egg. There was one female. Nest 127 was another small nest with one female.

Mischocyttarus ater (Oliv.).

Vespa atra Olivier, 1791 : 674.
Polybia atra Saussure, [1854–5] (text and plate 24, fig. 5, but not p. 181).
Megacanthopus ater Ducke, 1906 : 689.
Mischocyttarus ater Ducke, 1918 : 351.
Polistes ignobilis Haliday, 1838 : 322.
Polybia socialis Saussure, [1854–5] (: 177 but not plate 24).
Polybia decepta Fox, 1895 : 269, **syn. n.**
Megacanthopus imitator Ducke, 1904 : 362
Mischocyttarus ater var. *uniformis* Bequaert, 1938 : 134.

♀. Black; mandibles, inner and outer orbits more or less, antennal segment 1 beneath and three or four distal segments beneath, usually *pitchy-red*; part of pronotum sometimes reddish. Tegulae black. Wings black, usually with distal third or quarter of fore-wings white, less commonly subhyaline or (var. *uniformis* Beq.) dark fuscous. Surface of head and thorax with close rather short sub-recumbent brown or blackish pubescence, longer and more outstanding on mesopleuron and propodeum; abdomen and legs with dense appressed

microscopic paler pubescence, and also with sparser outstanding bristles; abdominal petiole with dense but rather short outstanding pubescence beneath, rest of sternites with longer but sparser pubescence which becomes still longer and dense on sternite 6. Length (H. + Th. + T1 + T2) 8·5–11·0 mm.

Structurally close to *M. tolensis* Rich. but differs as follows :—supraclypeal plate without larger punctures, those of clypeus sparse, ventral margin of clypeus more rounded, clypeus nearly one and a half times as broad as long; malar space about half as long as width of antennal socket; tentorial pits distinctly nearer to antennal sockets than to eyes; tempora about two-thirds width of eye; whole dorsal aspect of thorax and posterior face of propodeum dull, finely shagreened, very closely, moderately strongly punctured, propodeum with punctures separated by 1–2 diameters, no scattered larger punctures; mesopleuron dull with similar punctures but traces of sparse larger ones also; metapleuron considerably more finely punctured; pronotum with lateral fovea very strong, keel strong, sometimes lobate at sides, concave anteriorly; propodeum with its anterior region almost in same plane as postscutellum, with deep, usually well-defined, central furrow, not or little broadening below, separated by not more than one-sixth of its length from postscutellum, without central keel, angles of posterior face of propodeum unusually prominent, especially ventrally, dorso-lateral margin of valve-plate obtuse (3 spec.), subacute (9 spec.) or acute (28 spec.). Length of fore-wing 9·0–13·0, average 10·3 mm.; hamuli 8–15, average 11·1. Abdominal petiole much shorter than hind femur, hardly as long as hind coxa + trochanter, somewhat variable in shape, usually diverging strongly to spiracles and thence still diverging but to a less degree, dorsal surface in profile very convex, posterior about three times as broad as anterior margin, spiracular ratio 1 : 1, spiracles almost invisible from above, not projecting.

♂. Differs from ♀ as follows :—proximal half of mandibles, inner orbits between clypeus and eye-emargination, narrow outer orbits, antennal segments 1 and 8–13 beneath, considerable suffusion of pronotum, spot at top of prepectus, fore tibiae, *ferruginous*. Length (H. + Th. + T1 + T2) 7·5 mm.

Mandibles with three distal teeth; ventral margin of clypeus very little curved; antennal segment 3 a little longer than 1 + 2 or 4 + 5, 4–10 progressively shorter (8 about the thickest), 4 twice, 10 once as long as broad, 11 hardly thinner than 10, 12 a little longer and thinner than 11, 13 nearly three times as long as broad, shorter than 9 + 10, 3–12 beneath with shining line nearly half width of each segment, antennae not ciliate, somewhat spirally rolled; posterior sternites a little flattened but pubescence as in ♀; dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 9·0 mm.; hamuli 10. Genitalia similar to those of *M. frontalis* (Fox), aedeagus with 14 teeth beneath.

Specimens examined :—Mexico : Soconusco, 3 ♀ (*Purpus*) (B.); Cordova, ♀ (*Hoege*) (B.M.). Guatemala : Pochuta, Sta. Emilia, 1000 m., ii.–iii.1931, ♀ (J.B.); Solola, Olas de Moká, 3000 ft., ix.1908, ♀ (*G. P. Engelhardt*) (J.B.). Costa Rica : Mt. Redondo, 1902, ♀ (J.B.); Aserri, ♀ (*A. Alfaro*) (J.B.). Panama : Bugaba, 800–1000 ft., 2 ♀ (*Champion*) (B.M.). Peru : Col Perene, El Campamiento, 21.vi., ♀, 25.vi.1920, ♀ (C.). B.W.I. : Trinidad, 20.v.1933, ♀ (*D. Vesey FitzGerald*) (J.B.) [type of var. *uniformis* Beq.]. Dutch Guiana : Paramaribo, ♀ (*Heller*) (B.). Brazil : Amazons, Is. Marajó, R. Anajas, ♀ (*A. Ducke*) (B.M.); Rio de Janeiro, 16.x.1905, ♀ (*A. Ducke*) (B.), vii.–viii.1923, ♀ (*W. S. Bristowe*) (O.W.R.), Serro Itatiaya, 816 m., 12.i.1932, 7 ♀ (*J. Zikán*) (D.E.I.); Petropolis, bottom of Serra, 27.vii.1923, 4 ♀ (*H. Cott*) (B.M.), Gavea, 4.viii.1923, ♀ (*H. Cott*) (B.M.), Lagoinha, 23.vii.1923, ♀ (*W. S. Bristowe*) (O.W.R.); Minas Gerães, Diamentina, 1923, ♀ (*W. S. Bristowe*) (O.W.R.); São Paulo, east of, ♀ (B.M.), Sto. Amaro, ix.–xi.1921, ♂♀ (B.); Santa Catharina, ♀ (*Eschh.*) (B.), highlands; 2 ♀♀ (*E. Uhle*) (B.); State doubtful, Barreira, ii.1904, ♀ (*Prof. Bresslau*) (B.); " Brazil," 2 ♀ (*Sellow*) (B.). Paraguay : Alto Parana, Pto. Bertoni, ♀ (*Bertoni*) (B.M.).

The synonymy quoted above is due to Ducke (1918 : 351) except that of *Polybia decepta* Fox, which was pointed out to me by Dr. J. Bequaert.

M. ater (Oliv.) is a rather variable species in detail, though always very distinct from any of its allies. Most specimens have the tip of the wing beyond the pterostigma white, but the var. *uniformis* Beq., from Trinidad, has the wings only a little paler distally; similar, but not quite such extreme forms, are ♀ Paraguay, 2 ♀ Sta. Catharina, ♀ Diamentina; a ♀ Bugaba has the tip of the wing hyaline rather than white.

The shape of the abdominal petiole is also rather variable. Dr. J. Bequaert sent three specimens (♀ Costa Rica, Aserri, 2 ♀ Guatemala) and the three Mexican ♀ which have the petiole broader basally and dorsally more convex; the exact shape of the petiole varies considerably in the series I have examined. There is further variation in the strength of the pronotal keel and in the degree to which it is lobately produced laterally. The colour of the integument varies less; the head (including mandibles) may have considerable reddish areas or be almost entirely black; the same variation occurs in the colour of the pronotum (especially laterally). Ducke (1904 : 362, pl. 1, fig. 5, a, b, c) (as *Megacanthopus imitator*) describes and figures the nest from Pará. The nest figured is of a regular mushroom shape of about 45 cells with about 12 cocoons irregularly distributed. The petiole is central and was found attached to trees or under roofs. R. von Ihering (1904 : 255) describes nests in S. Paulo. Zikán (1935 : 183–6, pl. 3, figs. 5–6) gives some further details. The nests are usually red-brown in colour in the neighbourhood of Rio de Janeiro. The petiole is flattened and usually central unless the place of attachment makes a narrow comb more suitable. Bertoni (1911 : 126), in Paraguay, states that the nest is always rounded with a robust petiole emitted one cell from the margin. The nest is obscure in colour with a dark varnish. The nest is attached to the sides of walls, so that the petiole is horizontal. Bequaert (1937) received a female and nest taken from a bunch of bananas at Madison, Wisconsin. There were 8 cells, the completed ones 11·0 × 4·0 mm. FitzGerald (1938 : 183–4), in Trinidad, states that the nests are small, rarely more than 10 cells. A drop of clear honey-like fluid is sometimes found in cells otherwise empty or containing an egg. Neither wasp nor nest is very conspicuous but the adult closely resembles the aggressive *Parachartergus apicalis* (Fab.). Salt in Poulton (1931 : 19) found in a Syntomid moth, *Pseudosphex strigosa* Druce ♂, which was a very close mimic of *M. ater* at Rio Frio, Colombia. Ducke (1904) notes the resemblance of the wasp to *Parachartergus fraternus* (Grib.).

I have examined 5 nests (pl. 3, figs. 161–5) of *M. ater* (Ol.). No. 406 and 410, Brazil : Petropolis, hanging from roof of cottage at bottom of serra, 27.vii.1923 (*H. B. Cott*) (B.M.); No. 407, Brazil : Rio de Janeiro, Gavea, 4.viii.1923 (*H. B. Cott*) (B.M.); No. 408, Panama : Bugaba (*Champion*) (B.M.); No. 409, Mexico : Cordova (*Hoege*) (B.M.). No. 406 is dark reddish-brown, covered all over with varnish which makes the surface moderately shining. Apparently made of wood-fragments, mostly of one size and oval. The petiole is 5·0 mm. long, 7·0 mm. broad in one direction and 1·0–1·5 mm. in the other, *i.e.* strongly flattened. It is attached to the comb almost exactly centrally. The comb is 62·0 × 30·0 mm., the long axis a little concave, the proximal surface convex. The cells are in regular rows which run at right angles to the broad axis of petiole, and in oblique lines making an angle of about 30° with the broad axis. There are 8 rows of 9, 13, 14, 14, 13, 12, 11, 7 = 93 cells. New cells are built as pockets along both outer edges of the rows, their proximal ends nearly level with those of earlier cells. The tallest cells (including at one

end some cocoons) are 5–6 cells at each end of the three middle rows; they are 11·0 × 4·0 mm. The nest has 5 cocoons and the other cells are now empty. The cocoon cap is attached about 0·5 mm. inside the distal end of the cell, it is nearly flat, dark brown, with traces of silken strands and a moderate number of wood fragments included. Nest 410 was similar with 3, 3, 4, 2 = 12 cells. The two middle rows mostly complete, with one cocoon in each. Apparently 6 cells had small drops of honey in them but this requires verification in more freshly taken nests. Nest 407 was attached to perhaps a twig and had a large plate of attachment 9·0 × 7·0 mm. The petiole is 4·0 mm. long and 3·0 × 1·0–1·5 mm. broad. There are 6, 7, 7, 7, 7 = 34 cells, all, except two at one end of an outer row and the one next to it, are complete and wasps have emerged from them. Nest 408 also had a central petiole and 5, 7, 9, 8, 5 = 34 cells. The completed cells form an area in the middle and the short cells are at each end of the rows and along one outer row. No cells were being used a second time. Nest 409 is light reddish-grey with a silvery-grey varnish and had evidently been attached to something wooden. The attachment plate is 5·0 × 3·0 mm. The petiole is flattened and attached to one end of one of the outer rows of cells (further building might have made it more central). There are three rows of three cells and a very small one at centre of one outer row. The middle row is of completed cells but there are no cocoons.

Mischocyttarus immarginatus Richards, 1940 : 182.

♀. Black; inner orbits from clypeus to middle of eye-emargination, outer orbits (more or less), pronotal keel and a narrow anterior, sometimes interrupted and sometimes more pitchy, margin of scutellum, back of axillae, anterior half of postscutellum, large oval spots (extending two-thirds of its length (in one specimen very reduced)) on each side of propodeal furrow beneath, orifice and valve-plates, spot at top of prepectus, spots just in front of mid and hind coxae, usually two dorsal streaks on hind coxae, distal spots on all femora, segment 5 of fore tarsi, narrow posterior bands (dorsal and ventral) on abdominal segments 1 and 2, *pale yellow*. Mandibles (except tips of teeth), ventral margin or often whole of clypeus, antennae beneath, sometimes lateral aspect of pronotum, often irregular pleural marks, articulations of legs, more or less distinct anterior streak on tibiae, *ferruginous*. Tegulae brown, proximally black. Wings nearly hyaline or somewhat brownish. Surface of head and thorax with close short semi-recumbent pale pubescence, longer on ventral third of clypeus; legs and abdomen with dense microscopic pale pubescence, legs also with inconspicuous pale bristles; abdominal petiole with moderately close outstanding pubescence beneath, other sternites with similar but shorter and sparser pubescence, becoming denser on 4–6. Length (H. + Th. + T1 + T2) 11·0–12·0 mm.

Structurally resembles *M. tolensis* Rich. except in the following particulars :—ventral margin of clypeus a little less produced; tentorial pits about equidistant from eyes and antennal sockets; occiput without trace of a margin, dorsally behind the eyes one and a half times as broad as POL; propodeum with close, moderately strong punctures (all of one size) separated by 1–2 diameters; posterior margin of furrow behind anterior margin of pronotum angled though obtuse, fovea present (unusually small in 4 spec.), keel more obtuse; propodeum with an anterior, horizontal area not very well indicated (more than in *M. tolensis* Rich., less than in *M. metathoracicus* (Sauss.)), central furrow rather shallow and ill defined, but not strongly broadening below, central keel just indicated, furrow separated by one-third to one-quarter its length from postscutellum, dorso-lateral margin of valve-plate acute (22 spec.), subacute (7 spec.), or obtuse (3 spec.); claws of hind tarsi more asymmetrical; length of fore-wing 9·0–11·5, average 10·2 mm.; hamuli 8–13, average 10·9.

Abdominal petiole fully as long as hind femur, narrow and parallel-sided to spiracles,

thence diverging and then contracting a little again, posterior about two and a half times as broad as anterior margin, spiracles a little projecting.

♂. Differs from ♀ as follows:—antennae and legs more extensively ferruginous; a large mesosternal patch behind each fore coxa (in allotype, not in 3 other ♂), postero-lateral corner of propodeum, *ferruginous*; pubescence longer and more silvery, especially on clypeus; sternites 5–7 with rather dense, outstanding pubescence; length (H. + Th. + T1 + T2) 11·5 mm.

Mandibles with three distal teeth; antennae with segment 3 considerably longer than 1 + 2 and a little longer than 4 + 5, 4–10 progressively shorter (8 about the thickest), 4 twice as long as broad, 10 quadrate, 6–10 somewhat flattened beneath, 11–13 becoming longer and thinner, 13 two and a half times as long as broad, as long as 11 + 12, antennae with segments 3–9 with a narrow, shining, longitudinal area, not ciliate, distally sub-spirally rolled; POL : OOL = 3 : 4, occiput dorsally behind eyes as wide as POL (or rather narrower); tempora less than half as wide as eye; dorso-lateral margin of valve-plate of propodeum acute (1 spec.), subacute (2 spec.) or obtuse (1 spec.); length of fore-wing 9·5–10·5, average 10·0 mm.; hamuli 10–11, average 10·5.

Specimens examined:—Mexico: N. Yucatan, ♀♂ (type and allotype) (B.M.), Tepic, viii., ♂ (*Goldsmith*) (J.B.), Yucatan, Chichen Itza, vi.1929, ♀ (J.B.), ♀ (D.E.I.); Guerrero, Tepetlan, 3000 ft., vi., ♀ (*H. H. Smith*) (B.M.); Vera Cruz, Cordoba, ♀ no. 1342 (*P. Rau*) (J.B.); Tamaulipas, Victoria, 5 ♀ no. 1371 (*P. Rau*) (J.B.); San Luis Potosi, Tamazunchale, 5 ♀ no. 1358, 2 ♀, 1 ♂ no. 1360, 4 ♀ no. 1361, 2 ♀ no. 1363, ♀ no. 1365, ♀ no. 1366, ♀ no. 1369 (*P. Rau*) (J.B.), 35 kil. S. of Tamazunchale, Canon de Gallana, 2 ♀ no. 1326 (*P. Rau*) (J.B.), Valles, 2 ♀ no. 1328 (*P. Rau*) (J.B.), 50 kil. S. of Valles, Hiuchihuayan, ♀ no. 1373 (*P. Rau*) (J.B.). Nicaragua: Managua ♂ (*Artemio-René*) (J.B.). U.S.A.: Philadelphia, at light in banana-hold (from Mexico), 6.viii.1935, ♀ (*A. B. Wells*) (J.B.).

The relationship of *M. immarginatus* Rich. to its allies is sufficiently shown in the key. It appears to be closest to *M. tolensis* Rich. Superficially, it closely resembles *M. cubensis* (Sauss.) var. *mexicanus* (Sauss.) but besides the character of the proepisternum, it differs in its stronger sculpture, broader clypeus, more acute posterior margin of furrow behind anterior margin of pronotum, and longer abdominal petiole.

Group of *M. flavitarsis* (Sauss.) (text-figs. 43–62).

Characters of the adults given in the key (p. 308). The ♂ genitalia have been examined in eight of the fifteen species. They show no consistent differences from those of the group of *M. ater* (Oliv.). Specific differences are not very large and lie principally in the pubescence of the cuspis and of the parameral spine and in the number of ventral teeth on the aedeagus.

Larva. Since Reid's paper was published I have examined dried larvae of *M. cassununga* (R. von Iher.) and *M. wagneri* (du Buyss.). The larva of *M. cassununga* has two ventral lobes on the first abdominal sternite; they are parallel with the tips rounded. Coarse bristles are present on the ventral surface as well as on the lobes; they appear to be directed outwards and occur on seven segments. The head is brown with the labrum and labium pale. The larva of *M. wagneri* agreed in all these characters with that of *M. cassununga* and better material would be necessary for an attempt to distinguish them.

Nest. The petiole of the comb is usually eccentric and where it is central this is usually in large nests. The petiole is rarely much flattened.

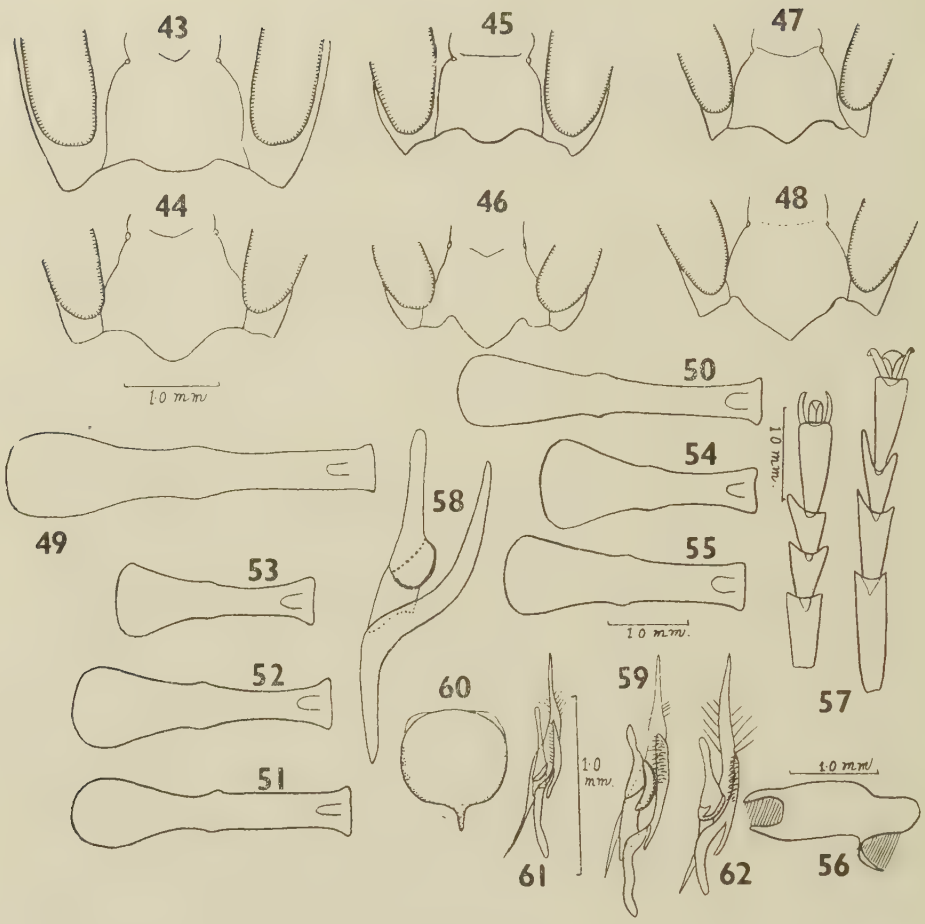
Mischocyttarus flavitarsis (Saussure).

Polybia flavitarsis Saussure, [1854] : 199.
Mischocyttarus (Myrapetra) flavitarsis Essig, 1926 : 888.

♀. Colour described under the varieties. Surface of head, thorax and propodeum with moderately close pale pubescence which is mainly outstanding except on mesonotum, where the appressed pubescence is browner; ventral half of clypeus with longer outstanding bristles; legs and abdomen (which is dull) with dense microscopic appressed pale pubescence, tibiae and tarsi also with sparse inconspicuous reddish bristles; abdominal petiole with a few fine outstanding bristles on proximal half dorsally, ventrally with rather numerous long ones and dense short ones, rest of sternites with appressed microscopic pubescence, only a little more outstanding on 5–6. Length (H. + Th. + T1 + T2) about 13·0 mm. (according to Bequaert (1932) 11·0–15·0 mm.).

Head dull, with very close, moderately strong punctures (almost granulate), supraclypeal plate and clypeus much more finely sculptured, ventral third of latter shining, with a few large punctures. Mandibles shining, very finely alutaceous, with rather numerous large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest rather longer than half width of antennal socket. Width of clypeus at its narrowest a little greater than its length, ventral third somewhat impressed, ventral margin moderately strongly produced in a regular curve over central two-thirds. Tentorial pits hardly nearer to eyes than to antennal sockets, well removed from both. Antennal sockets about one and a half times as far from one another as one is from eyes. Antennal segment 3 not quite as long as 1. Eyes hardly closer ventrally than dorsally, in contact with clypeus for a very short distance. Ocelli of moderate size, in an equilateral triangle, separated from one another by fully one and a half diameters of one, POL : OOL = 1 : 2. Occiput not margined, its width behind the eyes dorsally nearly twice the POL, tempora three-quarters width of eye. Thorax + propodeum about twice as long as broad, dull, mesonotum and pronotum with contiguous, rather small punctures (subgranulate), those of scutellum and postscutellum rather finer, of propodeum and mesopleuron a little less close than on mesonotum. Pronotum with anterior margin well raised but not reflexed, preceded by a shallow furrow the posterior margin of which is quite obtuse; lateral fovea present; keel weak and absolutely obtuse throughout, straight in dorsal view. Propisternum with anterior margin not raised or reflexed, lateral and posterior margins feeble but complete. Upper division of metapleuron obtusely produced along the meso-metapleural suture. Postscutellum moderately flattened but its anterior margin not in the same plane as scutellum. Propodeum with narrow anterior region horizontal, forming an angle with postscutellum, central furrow moderately broad, deep and well defined, ending about one-quarter of its length from postscutellum, no central keel, valve-plate with dorso-lateral margin obtuse (1 spec.), subobtuse (19 spec.) or acute (8 spec.). Mid tibia with two spurs of almost equal length; mid tarsi with segment 3 hardly at all asymmetrical, segment 4 only moderately produced. Hind tarsi with inner lobe of segment 3 not more produced than outer lobe of segment 4, the outer edge of which is two-thirds as long as its inner edge. Length of fore-wing 11·5–15·5, average 13·1 mm.; hamuli 9–16, average 12·4. Abdominal petiole as long as hind femur or a little longer, very slightly diverging to spiracles, thence more strongly diverging in almost straight lines, posterior two and a half or rather more times as broad as anterior margin, spiracular ratio 4 : 5, spiracles hardly perceptibly projecting (petiole a little shorter and wider in some specimens); membranous emargination of sternite 1 fully four times as wide as deep. Tergite 2 strongly expanded, as long as wide.

♂. Resembles ♀ except in the following particulars :—whole head more finely sculptured, part below antennae only just visibly punctured. Mandibles unpunctured, shorter, broader and more convex, most dorsal of four teeth blunter. Malar space at narrowest about as long as width of antennal socket. Clypeus a little broader, flattened and dull throughout, ventral margin not produced, only bisinuate. Tentorial pits a little closer to eyes than to



Figs. 43–62.

Fig. 43. Part of head with clypeus, *M. flavitarsis* (Sauss.) ♂.
44. The same, ♀.
45. The same, *M. pallidipectus* (Sm.) ♂.
46. The same, ♀.
47. The same, *M. bruneri* Beq. and Salt ♀.
48. The same, *M. duidensis* sp. n. ♀.
49. Dorsal view of abdominal tergite 1, *M. duidensis* sp. n. ♀.
50. The same, *M. wagneri* (Buyss.) ♀.
51. The same, *M. barbatus* sp. n. ♀.
52. The same, *M. barbatus* var. *cisandinus* var. n. ♀.
53. The same, *M. confirmatus* Zik. var. *cearensis* var. n. ♀.
54. The same, *M. cassununga* (R. von Iher.) ♀.
55. The same, *M. paraguayensis* Zik. ♀.
56. Left fore coxa from side, *M. flavitarsis* (Sauss.) ♀.
57. Left mid and hind tarsi, *M. flavitarsis* (Sauss.) ♀.
58. Ventral view of left volsellar plate and parameral spine, *M. marginatus* (Fox) ♂.
59. The same, *M. barbatus* sp. n. ♂.
60. Tergite 9, *M. barbatus* sp. n. ♂.
61. Ventral view of left volsellar plate and parameral spine, *M. confirmatus* Zik. var. *cearensis* var. n. ♂.
62. The same, *M. cassununga* (R. von Iher.) ♂.

antennal sockets. Eyes not or hardly coming into contact with clypeus. Occiput behind eyes dorsally more than twice as wide as POL; tempora as broad as eye. Antennae with segment 1 rather shorter and broader, 3 considerably longer than 1 + 2, a little longer than 4 + 5, about six times as long as broad, 4–9 gradually decreasing in length and increasing in thickness, 4 two and a third times, 9 nearly twice as long as broad, 10–13 becoming successively longer and thinner, 13 less than half the thickness and rather longer than 4, 12 as long as 6, no segment ciliate nor with a flattened or shining area beneath, antennae distally subspirally rolled. Propodeum with dorso-lateral margin of valve-plate acute (2 spec.) or subacute (2 spec.). Length of fore-wing 12·5–15·0, average 13·4 mm.; hamuli 10–14, average 11·7. Posterior margins of sternites 4–6 membranous but not recurved, sternite 7 flattened but pubescence not conspicuous, strongly shining. Genitalia in general resemble those of *M. superus* Rich. (fig. 85). The digitus is long, finger-shaped and membranous. Aedeagus with 13 long, narrow teeth.

In both sexes the margin of the valve-plate is frequently intermediate between the stages I term acute and subacute. It is possible that it is more acute in the specimens with a higher number of hamuli.

Colour variation.

Mischocyttarus flavitarsis var. *flavitarsis* (Sauss.).

♀. Black; mandibles except tips, clypeus, inner orbit to top of eye-emargination, most of area between and just above antennal sockets, antennal segment 1 beneath, broad outer orbits, small diagonal lines from inner-dorsal angle of eye to near centre of occiput, pronotal keel and broad, confluent posterior margin of pronotum, nearly anterior half of scutellum and axillae, post-tegulae, nearly anterior half of postscutellum and its lateral lobes, spot at top of prepectus, two large spots on each side of furrow and area round orifice of propodeum, narrow inner part of tegulae, fore femora distally and on ventral streak, fore tibia and tarsi, mid and hind legs with outer, dorsal streak on coxae, femora distally and tibiae and tarsi, about distal quarter of abdominal segment 1 (more at sides), whole of segments 2–6 (except indefinite, black, proximal marks on tergite and sternite 2), *bright yellow*. Rest of antennae, rest of tegulae, some indefinite markings on the trochanters *ferruginous*. Wings yellow-brown, darker in radial cell. Dorso-lateral margin of valve-plate of propodeum subacute (10 spec.) or acute (1 spec.). Length of fore-wing 11·5–13·5, average 12·8 mm.; hamuli 9–14, average 12·3.

♂. Differs from ♀ as follows:—antennae with segments 1–2 and (more or less) 12–13 darkened above; ventral angle of pronotum, whole mesosternal region and bottom of mesopleuron, metasternum, all coxae beneath, anterior surface of all femora, *yellow*. Mid and hind coxae not yellow-streaked dorsally. Dorso-lateral margin of valve-plate acute. Length of fore-wing 12·5, 15·0 mm.; hamuli 10, 12.

Specimens examined:—Mexico: no further data, ♂♀ (F. Smith coll.) (B.M.). U.S.A.: Colorado, ♀ (*Cockerell*) (B.M.), ♀ (*Morrison*) (B.), Platte Canyon, ♂ (*Oslar*) (J.B.), 10 m. S.E. of Lebanon, 25.viii.1935, ♀ (*G. Ferguson*) (D.E.I.); Oregon, Corvallis, 1.iii.1936, ♀ (*G. Ferguson*) (J.B.), 17.v.1935, 2 ♀ (*H. A. Scullen*) (B.M.); California, ♀ type and 1 ♀ (B.M.), Shasta Co., 2 ♀ (B.M.).

Bequaert (1933) also records the variety from the States of Utah and Nebraska.

There is considerable variation in the direction of reduction of yellow markings (approaching var. *idahoensis* Beq.) and also, according to Bequaert, in the direction of var. *centralis* Beq., in which the black is partly replaced by ferruginous.

In the female antennal segments 1 and about 7–12 may become black

dorsally; the area between clypeus and the occiput may become mainly black; the diagonal lines on the occiput may be reduced or disappear; most of the sides and a transverse, central band or else the whole ventral half of the clypeus may become black; the black markings of the second abdominal segment may become much more extensive and similar markings appear on some or all of the posterior segments. According to Bequaert, a pair of yellow lines is sometimes found on the mesonotum. In the male, apparently similar variations may occur.

Mischocyttarus flavitarsis var. *idahoensis* Bequaert, 1933 : 133.

♀. Resembles the darker forms of var. *flavitarsis* (Sauss.), but the yellow is usually still further reduced. The prepectus and dorsal surface of the mid and hind coxae are black. The dorsal side of the last 5–6 and often of the first antennal segments are black. The propodeum has the yellow markings reduced and in 3 out of 8 specimens almost entirely absent; in the same 3 specimens the clypeus is considerably, or in 1 (Victoria) almost entirely, black. Dorsal margin of valve-plate of propodeum subacute (4 spec.) or acute (5 spec.). Length of fore-wing 11·5–14·0, average 12·7 mm.; hamuli 10–13, average 12·1.

♂. Less distinct from that sex in var. *flavitarsis* (Sauss.). Valve-plate subacute; length of fore-wing 13·0 mm.; hamuli 14.

Specimens examined :—Canada : Alberta, Calgary, 2 ♀ (*Miss Ricardo*) (B.M.); British Columbia, ♀ (*Miss Ricardo*) (B.M.), Vernon, 4.viii.1912, ♀ (B.M.), " Vancouver," ♀ (F. Smith coll.) (B.M.), Victoria, 25.ix.1916, ♀ (*H. Hugh*) (J.B.). U.S.A. : Idaho, Warren, ♀ (J.B.), Potlatch, 6.x.1917, ♂ (D.E.I.); Utah, Salt Lake City, ♀ paratype (*S. Garman*) (D.E.I.). Hawaiian Territories : Honolulu (introduced), ♀ (*Mather*) (B.M.).

Bequaert also records the variety from the States of Oregon, Montana and Washington, but the bulk of his specimens came from British Columbia and it seems to be essentially a northern form.

Mischocyttarus flavitarsis var. *centralis* Bequaert, 1933 : 129.

♀. Differs from var. *flavitarsis* in having the black parts of the thorax, femora and abdomen more or less replaced by ferruginous. According to Bequaert, this substitution may be nearly complete. The few specimens I have examined differ principally from the yellower specimens of the typical form in having the dorsal (and in one also the ventral) black part of the petiole ferruginous. All have the five or six distal antennal segments darkened. The dorso-lateral margin of valve-plate of propodeum is subacute (4 spec.) or acute (2 spec.). Length of fore-wing 13·0–14·5, average 13·7 mm.; hamuli 11–15, average 13·0.

Specimens examined :—U.S.A. : Colorado, ♀ (*Cockerell*) (B.M.), 2 ♀ (*Morrison*) (B.); Utah, Uintah Co., Jensen, 27.vii.1930, 2 ♀ (*G. Fairchild*) (J.B.); Nebraska, Sioux Co., Squaw Canon, 18.vi.1896, ♀ paratype, (D.E.I.).

Bequaert also records the variety from the States of New Mexico and Texas and states that there is no sharp line between it and var. *flavitarsis*, the males being hardly separable.

Mischocyttarus flavitarsis var. *navajo* Bequaert, 1933 : 131.

♂♀. On the average larger than var. *flavitarsis*. Wings rather dark brown. Yellow markings similar to a moderately dark specimen of var. *flavitarsis*. Dorso-lateral margin of valve-plate subacute or obtuse (♀) or acute (♂). Length of fore-wing 15·5 mm. (♀), 15·0 mm. (♂); hamuli 12, 16 (♀), 11 (♂).

Specimens examined :—U.S.A. : Arizona, Fort Grant, Pinaleno Mts., 15–18.vii.1917, 2 ♀ (J.B. and D.E.I.), S. Arizona, ♂ (J.B.).

Mischocyttarus flavitarsis var. *kaibabensis* Bequaert, 1933 : 133.

Resembles var. *navajo* in its dark wings but differing in having the black parts almost entirely replaced by ferruginous.

Only known from 2 ♀ U.S. : Arizona, Cococino Co., Grand Canyon (Mus. Comp. Zool., Harvard) (not examined).

The facts known about the nest and biology of this species have been summarised by Bequaert (1933 : 123–5). The species ranges from British Colombia to Texas and just into northern Mexico, not apparently nesting above 8000 ft. The colonies are founded by single hibernated females. He describes and figures a nest with a flat comb, 38 × 25 mm., of 45 cells which when complete were 5 × 20 mm. The cocoon cap was thin, apparently of silk only. The nest was made of coarse grey paper in which wood fibres were distinctly visible. The petiole was eccentric and placed at the upper end, so that the comb hung nearly vertically, with the cells at the upper end nearly horizontal and those at the lower end opening downwards. Another nest of about 55 cells is described in which the petiole is much more nearly central. Bequaert records in all seven stylopised specimens, at least six of which were females. None showed any tendency towards male characters. Bequaert summarises much of the information about the mimetic groups into which the varieties of *M. flavitarsis* enter.

The following species resemble in colour the various forms :—

(1) var. *flavitarsis* (Sauss.), in California, *Polistes fuscatus* var. *aurifer* (Sauss.), *Ancistrocerus sutterianus* Sauss. and some other insects.
(2) var. *centralis* Beq., in Utah and Colorado, *Polistes fuscatus* var. *centralis* Hayward.
(3) var. *navajo* Beq., at Port Creek Canyon, *Polistes canadensis* var. *navajo* (Cress.), *Ancistrocerus navajo* J. Beq. and *Sphiximorpha loewii* (Williston) (Syrphidae).
(4) var. *kaibabensis* Beq. occurs with *Polistes canadensis* var. *kaibabensis* Hayward.
(5) var. *idahoensis* Beq. *Polistes fuscatus* var. *utahensis* Hayward and *Batazonus flavipennis* N. Banks (Pompilidae).

Mischocyttarus pallidipectus (Smith).

Polybia pallidipectus Smith, 1857 : 128.

♀. Black; more or less large, dorsal, proximal mark on mandibles, sometimes produced part of clypeus, inner orbits more or less broadly from clypeus to just above middle of eye-emargination, outer orbits either on dorsal half or also with a discontinuous stripe on ventral half, pronotal keel and posterior margin, sometimes ventral angle of pronotum, posterior angle of tegulae, narrow anterior margin to scutellum (narrowly interrupted) and post-scutellum, post-tegula and lateral lobes of postscutellum, two rather narrow stripes on each side of ventral half of propodeal furrow, valve-plates, small mark at top of prepectus, small sternal marks in front of mid and hind coxae, often dorsal streak on mid coxa, two dorsal streaks on hind coxa (inner one sometimes absent), distal dorsal marks on mid and hind femora, distal fifth or less of abdominal petiole both above and beneath (ventrally the yellow is sometimes interrupted on disc), narrow posterior bands on tergites and sternites 2 or 2–3 (bands on sternites often interrupted), *pale yellow*. Tip of mandibles, more or less of antennal segments 3–12 beneath, greater part of all tibiae anteriorly, mid and hind basitarsus, *ferruginous* or *brown*. Tegulae (apart from yellow spot) black with narrow brown margin. Wings hyaline, costal area of fore-wings brown tinged, radial cell infuscate. Surface of head, thorax and propodeum with moderately close, pale, appressed pubescence, which becomes longer and outstanding on the propodeum ventrally and on the mesosternum; mandibles and ventral third of clypeus with outstanding, reddish bristles; legs

and abdomen with dense, pale, microscopic, appressed pubescence, tibiae and tarsi with inconspicuous, reddish bristles; abdominal petiole on proximal half with some long, outstanding pubescence dorsally, ventrally with numerous, moderately long, outstanding pubescence, rest of sternite with appressed, microscopic pubescence, only a little more outstanding on 5–6. Length (H. + Th. + T1 + T2) 10·0–11·5 mm.

Structurally very similar to *M. flavitarsis* (Sauss.) but differs as follows :—vertex rather more finely and closely punctured; clypeus ventrally more angularly produced over central half (not two-thirds); antennal segment 3 tending to be a little longer compared with 1; eyes a little closer ventrally; thorax with punctures somewhat closer and finer; postscutellum more flattened; propodeal furrow tending to end farther from postscutellum (more nearly at one-third of its length), valve-plate obtuse (32 spec.) or subacute (19 spec.); hind tarsi with inner lobe of segment 3 a little more produced; outer edge of segment 4 three-fifths as long as inner; length of fore-wing 9·0–11·5, average 10·2 mm.; hamuli 8–12, average 9·6; abdominal petiole a little narrower.

♂. Black; mandibles (except reddish tips of teeth), lower anterior aspect of head up to level of top of antennal sockets and centre of eye-emarginations, antennae beneath, more or less widely interrupted stripe on outer orbits, keel, posterior margin and ventral angle of pronotum, narrow, interrupted anterior stripe on scutellum, post-tegulae, narrow, anterior stripe on postscutellum and its lateral lobes, rather narrow stripes on each side of ventral two-thirds of propodeal furrow, valve-plates, small or minute spot at top of prepectus, whole meso- and metasternum, ventral surface of all coxae, sometimes dorsal stripe on hind coxae, anterior face of fore femora, antero-dorsal stripe on mid and hind femora, posterior fifth or less of abdominal petiole (more ventrally), narrow, posterior margins to segments 2 or 2–3 (or ventrally 2–4), *pale yellow*. Antero-ventral part of mid femora, all tibiae and tarsi (except more or less distinct blackish areas on mid and hind tibiae distally, and segments 2–5 of mid and hind tarsi), large discal areas on abdominal sternites 2–4, *ferruginous*. Tegulae with a brown outer margin. Wings hyaline, costa brownish, radial cell infuscate. Pubescence as in the female but longer and more outstanding except on clypeus where it is short and silvery; on sternites 2–7 only distinctly outstanding on 7 and these quite short. Length (H. + Th. + T1 + T2) 9·5–11·5 mm.

Structurally resembles male of *M. flavitarsis* (Sauss.) except in the following particulars :—mandibles more flattened; malar space only half as long as width of antennal socket; clypeus less flattened, ventral margin produced into a distinct curved lobe over its central half; tentorial pits more than twice as near to eyes as to antennal sockets; eyes in contact with clypeus for a considerable distance; tempora only three-quarters as broad as eye; propodeal furrow tending to end farther from postscutellum, valve-plate obtuse (8 spec.), subacute (6 spec.) or acute (3 spec.); mid tibia with one spur more or less reduced, two-thirds length of other (type ♂), one-third length (2 spec.), less than one-fifth (1 spec.), absent (12 spec.); length of fore-wing 8·5–11·0, average 10·0 mm.; hamuli 7–11, average 9·0. Genitalia like those of *M. flavitarsis* (Sauss.) but aedeagus with 11–12 teeth beneath.

Specimens examined :—Mexico : Guerrero, Acaguizotla, 3500 ft., x., ♀ (*H. H. Smith*) (B.M.), Amula, 6000 ft., ix., ♂, 3 ♀ (*H. H. Smith*) (B.M.), Soledad, 5500 ft., vii., ♂ (*H. H. Smith*) (B.M.), Xucumanatlan, 7000 ft., vii., ♀ (*H. H. Smith*) (B.M.), Chilpancingo, 4600 ft., vi., 3 ♂, 1 ♀, viii., ♂ (*H. H. Smith*) (B.M.), nr. Chilapa, x.1929, 16 ♀ from nest (*L. Schultze*) (B.); Morelos, Cuernavaca, vi., ♂♀ (*H. H. Smith*) (B.M.); Puebla, Tehuaran, ix., ♀ (*C. A. Purpus*) (B.); Vera Cruz, Cordova, ♂ (B.M.), ♀ (*Hoege*) (B.M.), Orizaba, xii.1887, 6 ♀ (*H. H. Smith and F. D. Godman*) (B.M.), Jalapa, ♂ (*F. D. Godman*) (B.M.); Oajaca, 2 ♀ (B.M.); State not known, Coatepec, 4 ♀ (*J. Quiroz*) (B.M.), Mextill t.t., ♀ (B.), Soconusco, 25.vii., ♀ (*C. A. Purpus*) (B.), Sierra Mixteca, ♀ (*C. A. Purpus*) (B.), " S. Mexico," ♂ (F. Smith coll.) (B.M.), " Mexico," ♂ type (F. Smith coll.)

(B.M.), 4 ♀ (B.M.), ♂, 2 ♀ (*Ehrenberg*) (B.), ♀ (*Deppe*) (B.), ♂, 3 ♀ (Wilson Saunders coll.) (O.). GUATEMALA: Duenas, ♂ (*G. C. Champion*) (B.M.). REP. HONDURAS: Teguicigalpa, 16.x.1917, ♂, 3.ii.1917, ♂, 28.vii.1918, ♂, 9.xi.1917, ♀ (*F. J. Dyer*) (J.B.).

The species is thus found from the States of Guerrero and Vera Cruz in Mexico down to the Rep. of Honduras. The variable reduction of one mid tibial spur in this species in spite of its normal development in the closely allied *M. flavitarsis* (Sauss.) is only another instance of the unreliability of this character for the foundation of genera in the VESPIDAE. Dr. J. Bequaert first discovered this variation in the present species.

I have examined one small nest (pl. 1, fig. 123) of *M. pallidipectus*, no. 405. MEXICO: Orizaba, xii.1887 (*H.H.S. and F.D.G.*) (B.M.). It is stated on the label that it was found "under projecting part of stone wall. Several wasps on nest." It is light brown, made of flattened, mostly moderate-sized oval wood-fragments, very little varnished, except on the petiole which is 4·0 mm. long and 1·0–1·5 mm. broad. The attachment plate is 3·0 × 2·0 mm. and there is a moderate cone of attachment to the cone. The slight flattening of the petiole is parallel to the axis of the cell-rows. There are 3, 4, 3 = 10 cells and the petiole is attached to the end cell of an outer row. No cell is complete, the largest being 5·0 × 3·3 mm.

Mischocyttarus hirsutus sp. n.

♀. Colour-pattern described under the varieties. Structurally close to *M. flavitarsis* (Sauss.) but differs as follows:—vertex more finely and closely punctured (about as in *M. pallidipectus* (Smith)); clypeus with scattered, large punctures throughout, ventrally more angularly produced (a little less than in *M. pallidipectus* (Smith)) over central half; its width a little greater compared to its length; antennal sockets hardly farther from eyes than they are from one another; antennal segment 3 as long as 1; eyes a little closer together ventrally; thorax with punctures closer and finer (as in *M. pallidipectus* (Sm.)) but pleuron and propodeum with traces of sparse larger punctures; pronotum with lateral quarter of keel distinctly sharp-edged though little raised; postscutellum more flattened, in profile forming an almost continuous curve with scutellum; propodeum with anterior horizontal area less distinct, furrow rather weak, ending half to two-thirds of its length from postscutellum, central keel indicated, dorso-lateral margin of valve-plate acute (28 spec.), subacute (6 spec.) or obtuse (1 spec.); hind tarsi with inner lobe of segment 3 a little more produced, outer edge of segment 4 three-fifths as long as inner; length of fore-wing 10·5–13·0, average 11·99 mm.; hamuli 7–10, average 8·66; abdominal petiole rather narrower (about as in *M. pallidipectus* (Sm.)), spiracles more projecting.

♂. Structurally resembles ♀ except in the following particulars:—clypeus hardly punctured, ventral margin not impressed, roundly produced into a feeble lobe; mandibles with four teeth, dorsal one short, obtuse; malar space hardly half as long as width of antennal socket; tentorial pits about twice as near to eyes as to antennal sockets; eyes distinctly closer ventrally than dorsally, in contact with clypeus for a moderate distance; antennae with segment 1 shorter and broader, 3 a little longer than 1 + 2, distinctly longer than 4 + 5, 4–9 gradually decreasing in length, 4 nearly twice, 9 once as long as broad, 10–12 a little narrower than 9, 10–11 just transverse, 12 a little longer than broad but not longer than 9, 13 much thinner, half the thickness of and a little longer than 4, no segment ciliate or with shining areas beneath, antennae distally subspirally rolled. Dorso-lateral margin of valve-plate of propodeum acute (5 spec.), subacute (3 spec.), or obtuse (3 spec.). Mid tibiae with two equal spurs; length of fore-wing 10·0–12·5, average 11·09 mm.; hamuli 7–11, average 8·64; posterior margins of sternites 4–6 membranous but hardly recurved;

sternite 7 flattened, strongly shining. Genitalia with the setae of the cuspis unusually long and aedeagus with 17 very long narrow ventral teeth.

The species is very closely allied to *M. pallidipectus* (Sm.) but differs especially in the longer and more abundant pubescence, the stronger pronotal keel, the weaker and shorter propodeal furrow and the shorter eleventh and twelfth antennal segments in the male.

Mischocyttarus hirsutus var. **hirsutus** var. n.

♀. Black; narrow (sometimes interrupted) band along ventral margin of clypeus, inner orbits from clypeus to beginning of eye-emargination or a little farther, narrow stripe behind eyes on occiput, keel and posterior margin of pronotum, post-tegulae anterior band (not reaching sides) and lateral lobes of postscutellum, small marks on each side of propodeal furrow ventrally and valve-plates, dorsal streak on hind and sometimes on mid coxae, distal dorsal marks on femora, narrow, posterior margins to abdominal segments 1–2 or 1–3 (dorsally and ventrally), *yellow*; mandibles (except more or less large, ventral, proximal patch and the tips of the teeth), last three or four antennal segments beneath, small proximal mark and small distal area on femora, tibiae and tarsi (central part of tibiae and fifth tarsal segment darker), sides of tergite and sternite 2 (more or less), *ferruginous*. Tegulae testaceous. Wings moderately dark brown. Surface of head, thorax and propodeum with close, appressed, pale and also quite extensive long, outstanding, pale pubescence; legs and abdomen (which is dull) with dense, microscopic, appressed, pale pubescence, tibiae and tarsi also with a few, inconspicuous bristles; abdominal petiole with long, outstanding pubescence at sides and beneath, other sternites with some semi-erect, short pubescence which becomes long on 5–6. Length (H. + Th. + T1 + T2) 9–10 mm.

Dorso-lateral margin of valve-plate of propodeum acute (2 spec.) or subacute (1 spec.); length of fore-wing 10·5, 10·5, 11·0 mm.; hamuli 8, 9, 10.

♂. Black; almost whole of mandibles, broad ventral and lateral margins of clypeus, inner orbits to centre of eye-emargination, small streak behind eyes dorsally, mark on malar space, antennal segments 1 and 8–13 beneath, keel and posterior margin of pronotum, sometimes two small, transverse marks on the scutellum, narrow anterior margin of post-scutellum and its lateral lobes, two small, elongate marks on each side of propodeal furrow, valve-plates and other parts round orifice, large anterior patch each side of mesosternum, small marks at posterior edge of meso- and metasterna, ventral surface of fore and mid coxae, dorsal stripe of hind coxae, narrow posterior bands of tergites and sternites 1–4 (sternite 1 more broadly), *pale yellow*. Most of dorsal surface of all femora, whole of all tibiae and tarsi, *ferruginous*. Tegulae testaceous. Wings more hyaline than in female. Pubescence as in female but that on clypeus short and silvery; sternites 5–7 with short outstanding pubescence. Length (H. + Th. + T1 + T2) 9·0 mm.

Propodeum with dorso-lateral margin of valve-plate acute; length of fore-wing, 10·0, 10·0 mm.; hamuli 10, 11.

Specimens examined :—Ecuador : Tungurahua, Baños, 1600–1900 m., type ♀, allotype ♂, paratype ♂ (*W. C. MacIntyre*) (J.B.); Oriente, Rio Pastaza, Yonguilla, 1900 mm., ♀ paratype (*W. C. MacIntyre*) (J.B.). Colombia : Bogota, ♀ paratype (*Lindig*) (B.).

The type and allotype are in Dr. J. Bequaert's collection at the Mus. Comp. Zool., Harvard, Mass.; the ♂♀ paratypes from Ecuador have been presented to the British Museum.

Mischocyttarus hirsutus var. **rufomaculatus** var. n.

♀. Black; inner orbits to centre of eye-emargination, outer orbits narrowly dorsally, pronotal keel (very narrowly), ventral angle and posterior margin (more or less interrupted), transverse spot at anterior margin of scutellum and spots on its axillae, anterior third and

lateral lobes of postscutellum, broad but indefinite area on each side of propodeal furrow and others round propodeal spiracles (latter more or less red-suffused), metapleuron (more or less red-suffused), fore coxae ventrally, most of mid and hind coxae (except dorsal streaks), rest of legs (except anterior and posterior streaks on the femora, postero-distal patch on hind tibiae and segment 5 of mid and hind tarsi), narrow, posterior bands of abdominal tergites 1–3, whole of sternites 1–3, *yellow*. Mandibles and antennal segments 9–12 beneath *pitchy-red*. Abdominal tergites 1–2 (except posterior bands) pale *reddish-brown*, tergite 3 also somewhat reddish tinged. Tegulae testaceous, paler anteriorly. Wings moderately dark brown. Pubescence as in var. *hirsutus* but much shorter on head, especially dorsally; outstanding pubescence of head also nearly black. Length (H. + Th. + T1 + T2) 9·0–10·0 mm.

Structurally identical with var. *hirsutus*; dorso-lateral margins of valve-plate of propodeum acute, length of fore-wing 11·0, 12·5 mm.; hamuli 8, 9.

Specimens examined :—Ecuador, Tungurahua, Baños, 1600–1900 m., type and paratype ♀ (*W. C. MacIntyre*) (J.B.). The type is in the collection of Dr. J. Bequaert in the Mus. Comp. Zool., Harvard, Mass., the paratype in the collection of the British Museum.

Mischocyttarus hirsutus var. **tarmensis** var. n.

♀. Black; clypeus usually all black, sometimes with narrow ventral ferruginous border; inner orbits from clypeus to beginning of eye-emargination, narrow stripe behind eyes on occiput, distal half or two-thirds of mandibles, posterior margin of pronotum very narrowly, two small transverse marks at anterior border of scutellum, area surrounding propodeal spiracle and orifice, most of metapleuron, two anteriorly narrowed streaks on mesosternum, fore legs except some marks on trochanter and anterior streak on femur, mid leg except postero-dorsal area of coxa, dorsal and ventral streaks of femur, dorsal streak of tibia and fifth tarsal segment dorsally, hind legs except narrow antero-dorsal and broad postero-dorsal marks of coxa, most of trochanter, dorsal and ventral streaks on femur, proximal and distal inner black spots of tibiae, and fifth tarsal segment dorsally, *yellow*; last 3 or 4 antennal segments beneath, sides of abdominal petiole sometimes and of tergite 2 usually, *ferruginous*. Tegulae testaceous. Wings slightly infuscate, yellower along costa; pterostigma yellow-brown. Pubescence as in var. *hirsutus* but somewhat shorter on head and thorax. Length (H. + Th. + T1 + T2) 10·0–11·0 mm.

Structurally resembles var. *hirsutus*; propodeal furrow somewhat deeper and better defined; dorso-lateral margin of valve-plate of propodeum acute (24 spec.), subacute (5 spec.) or obtuse (1 spec.); length of fore-wing 11·0–13·0, average 12·13 mm.; hamuli 7–10, average 9·0.

♂. Resembles ♀ except :—clypeus usually with yellow ventral band; scutellum black; pale areas on metapleuron and propodeum much reduced; streaks on mesosternum sometimes broader and subconfluent posteriorly; hind coxae dorsally almost entirely black; length (H. + Th. + T1 + T2) 9·0–10·0 mm.

Structurally resembles ♂ of the typical form; propodeum with dorsal-lateral margin of valve-plate acute (3 spec.), subacute (3 spec.) or obtuse (3 spec.); length of fore-wing 10·0–12·5, average 11·33 mm.; hamuli 7–10, average 8·2.

Specimens examined :—Peru : Rio Tarma, Huacapistana, 1–2.vi.1920, 3 ♂, 4 ♀ (including ♀ type and ♂ allotype) (C.), 1–3.vi.1920, 6 ♂, 23 ♀ (C.), 10.vi.1920, ♀ (C.); Cam. del Pichis, Yapaz to Eneñas, 3.vii.1920, ♀ (C.); "Peru," vi.1920, ♀ (C.).

Some of the paratypes have been placed in my and in the British Museum collections.

Mischocyttarus pallidipes sp. n.

♀. Blackish-brown, partly suffused with pitchy-red; mandibles, clypeus, inner orbits to middle of eye-emargination, malar space, most of outer orbits and ventral surface of head, ventral angles and posterior margin of pronotum, sternal marks just in front of mid and hind coxae, proximal ventral half of fore coxae, proximal and distal mark on all femora, all tibiae and tarsi (hind tibiae and hind tarsal segment 5 somewhat darker) *yellowish* (pale yellow to yellow-brown). Antennae ferruginous ventrally. Tegulae testaceous. Wings light fuscous, pterostigma reddish-brown. Surface of head and thorax with not very close pale appressed pubescence, longer and outstanding on clypeus (especially ventrally) and on ventral half of propodeum; legs and abdomen with dense appressed microscopic pubescence, on abdomen almost sericeous, tibiae and tarsi with short reddish bristles in addition; abdominal petiole with only sparse outstanding pubescence, even ventrally; sternite 6 with rather long and dense, outstanding pubescence. Length (H. + Th. + T1 + T2) 9·0 mm.

Structurally similar to *M. flavitarsis* (Sauss.) except in the following particulars:— sculpture of head equally strong, clypeus with scattered large punctures throughout; width of clypeus quite distinctly greater than its length, ventral margin angularly produced over central half (as in *M. hirsutus* sp. n.); antennal sockets hardly farther from one another than they are from eyes; sculpture of thorax and propodeum a little finer than in *M. flavitarsis* (Sauss.), not quite so close and granulate as in *M. pallidipectus* (Sm.) and *M. hirsutus* sp. n.; lateral thirds of pronotal keel sharp-edged, moderately strong; postscutellum more flattened, in profile forming a continuous curve with scutellum; propodeum with a rather distinct central keel in furrow, dorso-lateral margin of valve-plate obtuse; inner spur of mid tibia two-thirds as long as outer; hind tarsi with inner lobe of segment 3 distinctly longer than outer lobe of segment 4 of which the outer edge is half as long as the inner, segment 5 one and a half times as long as 2; length of fore-wing 11·0 mm.; hamuli 8; abdominal petiole clearly a little longer, about as long as hind femur + trochanter, somewhat broader and shorter than in *M. hirsutus* sp. n.

Specimen examined:—Brazil, Santa Catharina, Thersepolis, type ♀ (*Michaelis*) (B.).

Zikán's (1935) key runs down to *M. confirmatus* Zikán (p. 375) or to *M. declaratus* Zikán; it does not agree completely with either description in which, unfortunately, a number of the more important characters are not mentioned.

It is closely allied to *M. hirsutus* sp. n., but the pubescence is much shorter and the propodeal furrow longer.

Mischocyttarus extinctus Zikán, 1935 : 183.

♀. Black; inner orbits to bottom of eye-emargination, outer orbits dorsally and (very indefinitely) ventrally, narrow posterior margin and ventral angles of pronotum, posterior processes of mesosternum, most of fore and mid coxae beneath, dorsal streak on hind coxae, anterior streak on fore femora, anterior and posterior streaks of mid and hind femora, fore tibiae (except dorsal streak), anterior and posterior streaks of mid and hind tibiae, all tarsi (segment 5 of hind tarsi darker) very narrow, posterior margin of abdominal tergite 1, lateral spots on tergites 2–4, broad, irregular bands on sternites 2–4 posteriorly, *yellow* or *reddish-yellow*. Mandibles and antennal segments 7–12 beneath, most of propodeum, posterior part of mesopleuron and top of prepectus, disc of mesosternum, *pitchy-red*. Tegulae testaceous, inner part black. Wings slightly infuscated, more yellow along the costa. Surface of head, thorax and propodeum with close pale mainly appressed pubescence, that on ventral part of clypeus, on vertex and on ventral part of propodeum longer and more outstanding; legs and abdomen (which is dull, hardly more shining

posteriorly with dense microscopic appressed pale pubescence, tibiae and tarsi also with some reddish bristles; abdominal petiole with moderately abundant outstanding pubescence at sides and beneath, sternites 3–5 with some outstanding pubescence, which on sternite 6 is dense. Length (H. + Th. + T1 + T2) 9·0 mm.

Structurally similar to *M. flavitarsis* (Sauss.) except in the following particulars :— sculpture of head finer, clypeus with some scattered, large punctures on its dorsal part; ventral margin of clypeus angularly produced over its central half (as in *M. hirsutus* sp. n.); antennal sockets very little nearer to eyes than to one another; sculpture of thorax and propodeum finer, closer and more granulate (as in *M. hirsutus* sp. n.); pronotal keel completely obliterated over a large central part, only the lateral eighth on each side present, sharp but little raised; postscutellum more flattened, forming a more regular continuation of scutellar surface; propodeal furrow deep, well defined, separated by one-quarter its length from postscutellum, with traces of central keel, dorso-lateral margin of valve-plate acute; outer edge of segment 4 of hind tarsi three-fifths as long as inner; length of forewing 10·5 mm.; hamuli 10; abdominal petiole relatively shorter and broader, clearly a little shorter than hind femur, spiracles rather more projecting.

Specimen examined :—Brazil : Minas Geraes, near Passo-Quatro, banks of R. Las Pedras, 1000 m., 1903, ♀ (*E. R. Wagner*) (J.B.).

This specimen has been determined, I think correctly, by Dr. J. Bequaert as *M. extinctus* Zikán, 1935. He suggests that *M. cryptobius* Zikán, 1935, is a synonym, but only an examination of authentic material could settle this point. Dr. Bequaert thinks that Zikán paid too much attention to differences between the single nests from which his specimens of each form were obtained.

Zikán (1935 : 183–6, pl. 2, fig. 3) describes a nest found on the wall of a house near Rio de Janeiro. The petiole was attached near the top of a vertical wall and the upper edge of the comb was attached to the roof by a small secondary petiole at right angles to the first. The nest was red-brown but somewhat darker than in *M. ater* (Oliv.) owing to an admixture of light grey tree-particles appearing as if mouldy. The petiole was short and broad, somewhat flattened (less than in *M. ater*) and nearly central. The comb was convex (not flat as in *M. ater*) so that the cells at the upper edge of the comb formed an angle of 60° with the wall and at the lower edge one of 120°. The nest was an old one with empty cells but five females still sat on the comb.

M. cryptobius Zikán is described as very similar to *M. extinctus* in colour and structure, but larger and ecologically different but Dr. J. Bequaert thinks that they may be conspecific. A nest is described from near Rio de Janeiro where it was attached inside the large rosette of a spiny Bromeliad. The nest was light brown in colour, as in *M. ater* and *M. extinctus*. The nest was in the centre of the narrow funnel (75 × 15 × 20 mm.) formed of the leaves and was fastened to the leaf by 6 short petioles of which one was thick and all were shining black. The distal surface of comb faced the opening of the funnel. The comb was of 4, 5, 6, 6, 5, 8, 7, 9, 9, 9, 7 = 75 cells in all stages of construction. On discovery 8 wasps were on the nest and 1 ♂, 3 ♀ were caught. Later 1 ♂, 9 ♀ emerged from cocoons.

Mischocyttarus bruneri Bequaert and Salt, 1931 : 790.

♀. Ferruginous; head except distal third of antennal segment 3 and whole of 4–12, marks in front of keel and ventral angles of pronotum, larger, posterior part of postscutellum, propodeum, metapleuron, narrow posterior strip (behind dorsal furrow) of mesopleuron, disc of mesosternum, coxae and femora (except small proximo-dorsal and distal patches of femora), irregular suffusions of the tibiae, abdominal petiole (except very narrow posterior band), *black*. Minute spot just below pronotal fovea *yellow*. Tegulae ferru-

ginous. Wings yellow-brown. Surface of head, thorax and propodeum with very short close pale appressed pubescence, only longer and outstanding on ventral half of clypeus; legs and abdomen with dense, microscopic appressed pale pubescence, tibiae and tarsi also with inconspicuous reddish bristles; abdominal petiole with almost no outstanding pubescence, even beneath; sternites 5–6 with close moderately long outstanding pubescence. Length (H. + Th. + T1 + T2) 9·0 mm. (8·0–9·0 mm. in original description).

Structurally similar to *M. flavitarsis* (Sauss.) except in the following particulars :—head more closely and finely punctured, the punctation of the clypeus and supraclypeal plate not closer than that of vertex; malar space nearly as long as width of antennal socket; clypeus half as wide again as long, roundly produced over central half of ventral margin, the produced part more angular than in *M. flavitarsis* (Sauss.) but less so than in *M. hirsutus* sp. n., etc.; antennal sockets as near to one another as to eyes; eyes hardly touching clypeus; POL : OOL = 1 : 3; occipital width behind eyes dorsally three times POL; tempora a little wider than eyes; sculpture of thorax + propodeum closer and finer, more granulate (as in *M. pallidipectus* (Smith)); pronotal keel obtuse throughout; propodeum with anterior horizontal region less distinct, furrow shallow, very ill defined, ending one-quarter its length from postscutellum, with traces of a central keel, dorso-lateral margin of valve-plates subacute; outer edge of segment 4 of hind tarsi three-fifths as long as inner; length of fore-wing 10·0 mm.; hamuli 11; abdominal petiole relatively a little shorter and broader, parallel-sided up to the spiracles.

Specimen examined :—Cuba : Sierra Maestra, 4500 ft., 10–20.vii.1922, ♀ (*O. H. Ballou and S. C. Bruner*) (J.B.; paratype).

This species, which is known so far only from two Cuban specimens, appears to be very distinct within the group.

Mischocyttarus marginatus (Fox).

Polybia marginata Fox, 1898 : 456.

♀. Black; inner orbits to near middle of eye-emargination, small dorsal streak on outer orbits, pronotal keel, posterior margin and ventral angles, inner part of scutellar axillae, anterior third of postscutellum and its lobes, moderately broad streak on each side of propodeal furrow, valve-plates, spots at top of prepectus and metapleuron, external spot on mid coxae, dorsal streak on hind coxae, distal spot on femora, *bright yellow*. Distal half of mandibles, antennae 1–2 and 7–12 beneath, mesonotum, scutellum, posterior margin of postscutellum, propodeum (except for the yellow streaks and a darker suffusion in the furrow), most of metapleuron, postero-dorsal part of mesopleuron, posterior margin of mesopleuron, legs (except for yellow markings; fore coxae darker), abdominal petiole (except posterior fifth), *ferruginous*. Tegulae yellowish-ferruginous. Wings somewhat infuscate, especially along the costa. Surface of head, thorax and propodeum with close, short appressed pale pubescence, only longer and outstanding on ventral half of clypeus and of propodeum; legs and abdomen (which is dull and sericeous) with shorter and denser pale pubescence, tibiae and tarsi also with inconspicuous reddish bristles; abdominal petiole beneath with moderately long and abundant outstanding pubescence, on other sternites pubescence short except 5–6, where it is dense and moderately long. Length (H. + Th. + T1 + T2) 12·5 mm.

Structurally similar to *M. flavitarsis* (Sauss.) except in the following particulars :—sculpture of head very uniform, fine and granular throughout, only extreme ventral margin of clypeus with a row of large punctures; malar space at narrowest as long as width of antennal socket; width of clypeus one and a half times its length; ventral part less impressed, considerably less produced; clypeus not touching eyes; POL : OOL = 2 : 5, width of occiput behind eyes dorsally two and a half times POL; sculpture of thorax and propodeum much finer and more granulate (a little finer than in *M. pallidipectus* (Sm.));

pronotal keel strong, sharp-edged and straight but completely interrupted over rather less than the central third; propodeum with central furrow broad, shallow and ill defined, ending about one-quarter its length from the postscutellum, central keel rather distinct, dorso-lateral margin of valve-plates subacute; hind tarsi with inner lobe of segment 3 a little longer than outer lobe of segment 4 of which the outer edge is three-fifths the inner; length of fore-wing 13·0 mm.; hamuli 11; abdominal petiole more expanded posteriorly, posterior three times as wide as anterior margin; spiracles a little more projecting; tergite 2 longer than broad.

♂. Resembles the female except in the following particulars :—inner orbits more extensively, antennae 1–2 and 9–13 beneath, central marks on the proepisterna and marks on mesosternum beneath each fore coxa, *yellow*. Most of mandibles, ventral half of clypeus, malar space, considerable suffusions of pronotum, most of meso- and metapleuron *ferruginous*; clypeal pubescence all short and silvery; length (H. + Th. + T1 + T2) 12·0 mm.

Clypeal sculpture even finer; clypeus flattened, wider, ventrally hardly at all produced, margin only bisinuate; malar space about as long as width of antennal sockets; eyes quite widely separated from clypeus where they approach most closely; antennae with segment 3 about as long as 1 + 2, a little longer than 4 + 5, six times as long as broad, 4–9 gradually decreasing in length and increasing in thickness, 4 not quite twice, 9 a little longer than once as long as broad, 10–12 of about the same length as 9 but decreasing in thickness, 13 less than half the thickness but rather longer than 4, no segment ciliate nor with a shining area beneath; dorso-lateral margin of valve-plate of propodeum subacute; spurs of mid tibiae of equal length; length of fore-wing 11·0 mm.; hamuli 11; abdominal sternites 4–6 with hyaline though unreflexed margins, 7 flattened, strongly shining with rather dense pubescence. Genitalia like those of *M. flavitarsis* (Sauss.) but digitus (fig. 58) somewhat broadened anteriorly. Aedeagus with 15 teeth beneath.

Specimens examined :—Paraguay : Sapucay, 8.iii., ♀, 8.iv.1903, ♂ (*W. T. Foster*) (J.B.). The female has been compared with the type by Dr. J. Bequaert.

Mischocyttarus chapadae (Fox).

Polybia chapadae Fox, 1898 : 453.

♀. Head *yellow*, partly ferruginous-tinged; mandibular teeth and ventral margin of clypeus pitchy-red; tentorial pits, margins of supraclypeal plate, large mark surrounding ocelli, sending out short lateral wings opposite lateral ocelli; and broad processes (a little produced into eye-emargination) to antennal sockets, occiput (to mandibles) and under surface of head, occipital mark being connected by a black band to postero-dorsal corner of eye and by a ferruginous band to ocelli, *black*; antennae orange, black dorsally, except last two segments. Thorax *ferruginous*, most of pronotum, lower part of mesopleuron and disc of mesosternum blackish suffused; keel and posterior margin of pronotum, two faint discal lines on mesonotum, scutellum (except narrow anterior and posterior margins and faint postero-discal cloud), postscutellum except posterior third, two large outwardly-curved bands on each side of propodeal furrow, dorsal half of prepectus, rather indefinite marks on both halves of metapleuron, *pale yellow*. Legs *ferruginous*, underside of fore coxa, slight postero-ventral streak on fore femur, ventral surface of mid coxa, distal half of femur beneath, inner and outer dorsal streaks of hind coxa, postero-distal mark on femur, *yellow*. Abdomen blackish-brown, segment 1 ferruginous with posterior quarter of tergite 1 yellow, tergites 2–4 with about posterior quarter (more at sides), yellowish, sternites 2–6 indefinitely yellowish posteriorly. Tegulae ferruginous with inner margin yellow. Wings hyaline, costal cell hardly yellow-tinged, venation light brown. Surface of head, thorax and propodeum with close appressed short pale pubescence (more golden on mesonotum), that on ventral third of clypeus longer but only semi-erect, that on ventral third of propodeum longer and more outstanding; legs and abdomen with shorter and denser pale pubescence,

that on tergites 2–5 clearly sericeous, tibiae and tarsi also with reddish bristles; abdominal petiole beneath with sparse short outstanding pubescence, that on sternites 5–6 longer and denser. Length (H. + Th. + T1 + T2) 13·0 mm.

Structurally similar to *M. flavitarsis* (Sauss.) except in the following particulars:— sculpture of head very uniform fine and subgranular; malar space at narrowest two-thirds as long as width of antennal socket; width of clypeus equal to its length, ventral quarter little impressed, ventral margin little produced, almost rounded; POL : OOL = 1 : 1·75; sculpture of thorax and propodeum a little finer (about as in *M. pallidipectus* (Sm.)); pronotal keel stronger, sharp-edged except over central third; propodeum with central furrow weaker, parallel-sided, only moderately well defined, separated by one-quarter its length from postscutellum, central keel very weak, dorso-lateral margin of valve-plate subacute; length of fore-wing 13·5 mm.; hamuli 13; abdominal petiole with sides a little more divergent posteriorly, spiracles a little more projecting.

Specimen examined:—Brazil: Matto Grosso, Chapada, ♀ (paratype of *Polybia chapadae* Fox) (J.B.).

This species is closest to *M. marginatus* (Fox), but it has a less broad clypeus, deeper propodeal furrow, less expanded abdominal petiole and coarser sculpture.

Mischocyttarus duidensis sp. n.

♀. Black; narrow streak on inner orbit to beginning of eye-emargination, small streak on dorsal part of outer orbit, *yellow*; dorsal proximal and distal marks on femora, all tibiae and tarsi (except distal fifth of hind tibiae, segment 5 of fore tarsi and 4 and 5 of mid and hind tarsi), dorsal part of abdominal petiole (except posterior fifth), *light ferruginous*. Tegulae black with a small ferruginous outer spot. Wings light yellow-brown, distal sixth fuscous. Surface of head, thorax and abdomen with long outstanding not very close pale pubescence, the usual short appressed pubescence only visible on the clypeus; legs and abdomen (which is dull and subsericeous) with dense microscopic appressed pale pubescence, tibiae and tarsi also with short, reddish bristles; abdominal petiole with long outstanding pubescence on all surfaces but only abundantly beneath, other sternites with short pubescence which becomes outstanding on 5 and especially 6. Length (H. + Th. + T1 + T2) 11·5 mm.

Structurally resembles *M. flavitarsis* (Sauss.) except in the following particulars:— clypeus with numerous though shallow, large punctures throughout, ventral margin angularly produced over its central two-thirds (a little more produced than in *M. hirsutus* sp. n.); antennal sockets hardly farther from one another than they are from eyes; POL : OOL = 2 : 5; sculpture of thorax and propodeum a little stronger, punctures more distinct, though still appearing subgranulate; pronotal keel quite obsolete, even at sides only detectable as a faint angulation between dorsal and anterior surfaces; tegulae closely, subrugosely punctured, dull; postscutellum more flattened, its surface almost a continuation in profile of that of scutellum; propodeum with anterior, horizontal part less distinct, furrow broad, shallow, ill defined, ending about one-quarter its length from postscutellum, lateral furrows indistinct, dorso-lateral margin of valve-plate acute; length of fore-wing 12·5 mm.; hamuli 10; abdominal petiole much longer and narrower, a little longer than hind femur + trochanter, parallel-sided up to the spiracles, then diverging moderately strongly, then for posterior quarter nearly parallel again, posterior hardly two and a half times as wide as anterior margin, spiracles rather strongly projecting.

Specimen examined:—Venezuela: Mt. Duida, 14.i.1929, type ♀ (*Tate*) (J.B.). The specimen is in Dr. J. Bequaert's collection at the Mus. Comp. Zool., Harvard, Mass. The species is one of the most distinct in the group in its long pubescence, obsolete pronotal keel and long petiole.

Mischocyttarus commixtus sp. n.

♀. Colour varying from dark brown to lighter or to black. Head black, clypeus and mandibles pale brown, inner orbits from clypeus to centre of eye-emargination and dorsal half of outer orbits yellow; antennae black, segments 10–12 reddish-brown beneath. Thorax and propodeum darker dorsally, paler ventrally, pronotal keel yellow; legs dark brown, femora with small proximal dorsal yellow spot. Abdomen chestnut-brown, tergite 1 darker. Wings a little infuscate. Surface dull, legs and tergite 1 more shining. Surface of head, thorax and propodeum with rather close, pale appressed pubescence which becomes longer, denser and more outstanding on propodeum; ventral half of clypeus with some outstanding bristles; legs and abdomen with dense, microscopic, appressed, pale pubescence, tibiae and tarsi also with sparse, outstanding, reddish bristles; abdominal petiole with moderately long and dense outstanding pubescence, rest of abdomen with appressed pubescence, except sternites 2 and 5–6 on which it is longer and suberect. Length (H. + Th. + T1 + T2) 10·0 mm.

Structurally similar to *M. flavitarsis* (Sauss.) but differs as follows :—head rather finely granulate; malar space at narrowest one-quarter as long as width of antennal socket; clypeus about as in *M. hirsutus* sp. n.; tentorial pits distinctly closer to eyes than to antennal sockets; eyes more approximated ventrally, where in contact with clypeus for a considerable distance; POL : OOL = 2 : 5; width of occiput behind eyes dorsally rather less than POL; pronotal keel straight, quite distinct but obtuse throughout; lateral margin of proepisternum obsolete; propodeum with anterior horizontal area not well marked, central furrow rather deep and well defined, separated by one-third its length from postscutellum; dorso-lateral margin of valve-plate of propodeum subacute; inner lobe of segment 3 of hind tarsi somewhat longer than outer lobe of 4; length of fore-wing 11·0 mm.; hamuli 11; abdominal petiole nearly as long as hind femur + trochanter, parallel-sided to spiracles, thence a little diverging almost in straight lines, posterior twice as broad as anterior margin, spiracular ratio 1 : 1, spiracles rather distinctly projecting.

Specimen examined :—Peru : Cam. del Pichis, Dos de Mayo to El Porvenir, 6.vii.1920, type ♀ (C.).

By combining the features of the two divisions of the present group, *M. commixtus* sp. n. is distinct but it shows considerable resemblance in other characters to several species. It is perhaps closest to *M. hirsutus* sp. n., but besides having a shorter malar space, the sculpture of the thorax is considerably less coarse and abdominal petiole is much narrower and considerably longer; the pronotal keel is also stronger. From *M. pallidipes* sp. n. it differs in the shorter malar space, much longer pubescence and longer and narrower abdominal petiole. In the other group, it is closest to *M. wagneri* (Buyss.) and *M. barbatus* sp. n.; it differs from both in the obtuse margin to the anterior pronotal furrow. From *M. wagneri* (Buyss.) it differs further in the much longer pubescence, deeper propodeal furrow and laterally unreflexed pronotal keel. From *M. barbatus* sp. n. it differs in the deeper propodeal furrow and granulate rather than punctured surface of the propodeum.

Mischocyttarus wagneri (du Buysson).

Megacanthopus wagneri du Buysson, 1908 : 219.
Mischocyttarus pedunculatus Zikán, 1935 : 159.

♀. Black; dorsal patch on mandibles, ventral margin of clypeus, whole inner orbits, two spots behind ocelli, whole outer orbits and malar space, keel and posterior margin of pronotum, two more or less distinct lines on disc of mesonotum, transverse line just behind anterior margin of scutellum, dorsal part of axillae, post-tegulae, anterior half of post-scutellum and its lateral lobes, broad stripes on either side of ventral two-thirds of propo-

deal furrow, orifice and valve-plates, spots at top of meso- and metapleura, posterior margin of mesosternum, latero-dorsal stripe on mid coxae, two dorsal stripes on hind coxae, distal mark on all femora, narrow posterior band on tergites 1–2, flattened triangular area on sternite 1, narrow, posterior bands on sternites 2–3, *yellow*. Sides of clypeus, antennal segments 1–3 and 9–12 beneath, ventral angle of pronotum, more or less distinct suffusion of the pleura of the fore tibia, of the four hind femora, tibiae and basitarsi, and of abdominal tergite 2, *ferruginous* or ferruginous-yellow. Tegulae black with the margin ferruginous and sometimes a posterior yellow spot. Wings hyaline, pterostigma yellow-brown, other venation darker. Surface of head and thorax with dense white appressed pubescence, that on ventral part of propodeum longer and more outstanding, ventral half of clypeus with some outstanding bristles; legs and abdomen with even denser and more microscopic appressed pale pubescence, tibiae and tarsi also with some outstanding reddish bristles; abdominal petiole with rather abundant long outstanding pubescence at sides and beneath, sternites otherwise with short pubescence which becomes longer and denser on 5–6. Length [10] (H. + Th. + T1 + T2) 8·5–10·0 mm.

Structurally resembles *M. flavitarsis* (Sauss.) except in the following particulars :—head dull, granulate, nowhere punctured except a few large punctures at ventral margin of clypeus which is a little shining; malar space at narrowest about one-quarter as long as width of antennal socket; clypeus as wide as long, ventral margin rather weakly triangularly produced over central third; tentorial pits almost twice as close to eyes as to antennal sockets; eyes in contact with clypeus for a moderate distance; POL : OOL = 1 : 2; occiput behind eyes dorsally one and a half times as wide as POL; tempora half width of eye; thorax and propodeum finely granulate, dull, not visibly punctured; pronotum with anterior margin strongly raised, preceded by a furrow the posterior margin of which is acute and overhanging, keel moderately strong and sharp-edged on lateral quarters, effaced in between, in dorsal view a little concave anteriorly; proepisternum with the anterior margin a little raised and reflexed; postscutellum more flattened, almost quite in same plane as scutellum; propodeum anteriorly with almost no horizontal region, furrow broad, not very deep, ill defined, separated by one-third its length from postscutellum, with a distinct central keel; lateral furrows obsolete, dorso-lateral margin of valve-plate obtuse; hind tarsi with inner lobe of segment 3 a little more produced, outer edge of segment 4 three-fifths the inner; length of fore-wing 8·0–9·5 mm., average 8·6 mm.; hamuli 7–10, average 8·3; abdominal petiole a little longer than hind femur + trochanter, parallel-sided to spiracles, thence diverging for half-distance to posterior margin, then parallel-sided, posterior nearly three times as broad as anterior margin, spiracular ratio about 5 : 4, spiracles quite strongly projecting.

Specimens examined :—Brazil : Rio de Janeiro, Mt. des Orgues, nr. La Tijuca, 900–1000 m., 1902, ♀ (*E. R. Wagner*) (Paris Mus.) [type of *M. wagneri* (du Buyss.)], Corcovado, 20.v.1912, ♀ (*G. E. Bryant*) (B.M.), Lagoinha, 23.vii.1923, ♀ (*H. B. Cott*) (B.M.), 1923, ♀ (*W. S. Bristowe*) (O.W.R.); Minas Geraes, 30 miles from Bella Horizonte, Morro Velho, viii.1935, 2 ♀ in garden, 1 ♀ in wooded area (*A. J. Musgrave*) (O.W.R.).

I have not seen the male, but according to Zikán the antennae are distally rolled. The specimens from Minas Geraes have the yellow markings a little reduced, particularly the discal lines of the mesonotum.

This species, together with the next three, forms a connecting link between the group of *M. flavitarsis* (Sauss.) and that of *M. alfkenii* (Ducke). It is convenient and probably also correct to keep in one group all the species with spirally rolled antennae in the male and to put those with simple antennae in another. The present species is in any case without close allies.

[10] Gives the impression of a small species but the abdominal petiole is unusually long.

Zikán described his *M. pedunculatus* from Rio de Janeiro, Itatiaya, and it is clearly recognisable from the description.

Zikán (1935 : 159–62, pl. 3, fig. 11) describes and figures the nest (as *M. pedunculatus*). Six nests were found near Rio de Janeiro, three hanging from plant-roots in the earth, two from dry fern-leaves and one from a rock on the edge of a stream. It seems to prefer lanes where on the banks there are projecting plant-roots. The nest on the rock was lighter red-brown, those on the roots greyer with a red-brown mixture, those on the ferns dark brown with a grey mixture. All the nests were irregular, with complete and half-made cells mixed together so that they resemble broken dry leaves, etc. This was especially true of the ones on ferns. The largest nest had 66 cells in an irregular triangle with a somewhat eccentric petiole. On it were 2 ♂, 8 ♀, and 4 ♂, 7 ♀ emerged later. Another nest of 29 cells had 8 ♀ on it and produced 2 ♂, 2 ♀ later. It was parasitised by an Ichneumonid with black white-banded abdomen such as attacks *M. iheringi* Zikán (cf. also *M. cassununga*, p. 379). Other nests were (*a*) 10 cells and 3 ♀, later producing 2 more ♀, (*b*) 8 half-finished cells and 1 ♀. A number of further nests which had just been started on roots were also found. On these there was only one female or a few wasps.

I have examined one nest, no. 404 Brazil : Lagoinha, 23.vii.1923 (*H. B. Cott*) (B.M.) (pl. 1, fig. 122), attached to a small piece of plant-stem. It is light brown in colour, irregularly reddish tinged, made of flattened wood-fragments of variable size, a number being elongate. There is little varnish except on the petiole. There are a certain number of " windows "—gaps closed by varnish only. The petiole is 3·0 mm. long and 1·5–1·0 broad, a little flattened at right angles to the long axis of the plant-stem but parallel to the cell-rows. The thin plate of attachment is 5·0 × 3·0 mm. and the cone of attachment is rather elongate. There are 3, 5, 5 = 13 cells, the petiole being attached to one end of the outer row of 5. The proximal surface of the comb is very oblique to the petiole. The completed cells are 13·0 × 3·3 mm. The distal surface of the comb is very irregular owing to the cells being in all stages of construction. Eggs were attached 4·0 mm. from the bottom of the cell but only two were found, most cells having apparently contained larvae and three of them pupae. The cocoon-cap of whitish-grey silk is very thin and fibrous and attached to the top of the cell, a little domed and criss-crossed by quite strong raised bands of nest-material.

Mischocyttarus barbatus sp. n.

Colour-pattern described under the varieties.

♀. Surface of head and thorax with moderately long and abundant outstanding, or at most semi-recumbent, pubescence; pubescence only shorter and more appressed on clypeus; legs and abdomen with dense microscopic pale pubescence, tibiae and tarsi also with some inconspicuous reddish bristles; abdominal petiole with abundant long outstanding pubescence on all surfaces, sternites 2–4 with recumbent pubescence, 5–6 with long, abundant, outstanding pubescence. Length (H. + Th. + T1 + T2) 9·0–10·0 mm.

Structurally resembles *M. flavitarsis* (Sauss.) except in the following particulars :— malar space at narrowest about one-quarter as long as width of antennal socket; ventral margin of clypeus rather weakly, hardly angularly produced over central half; tentorial pits a little closer to eyes than to antennal socket; punctures of thorax and propodeum a little stronger and less close (not quite so much so as in *M. duidensis* sp. n.); pronotum with the anterior margin strongly raised, preceded by a deep furrow the posterior margin of which is a strong right-angle, pronotal keel with the lateral quarters well raised but obtuse (hardly at all knife-like), in dorsal view straight; dorsal and prepectal furrows weaker;

propodeum with anterior horizontal area not at all distinct, furrow rather wide and deep, moderately well defined, separated by one-third its length from postscutellum, with a strong central keel, lateral keels obsolete; abdominal petiole as long as hind femur + trochanter, parallel-sided to spiracles, thence feebly diverging, spiracular ratio 1, spiracles strongly projecting, ventrally the posterior flattened area is not much longer than broad.

♂. Pubescence of face below antennae appressed, silvery; sternites 5–7 with short pubescence, not specially dense on 7 which is shining. Length (H. + Th. + T1 + T2) 9·0 mm.

Mandibles unpunctured, with three dorsal teeth relatively reduced; malar space a little shorter; clypeus unsculptured, ventral margin feebly and regularly rounded; tentorial pits at least twice as close to eyes as to antennal sockets; eyes in contact with clypeus along two-thirds of its sides, considerably closer below than on vertex; POL : OOL about 2 : 3; tempora hardly more than one-third width of eye; antennae with segment 1 shorter and broader, 3 about as long as 1 + 2, longer than 4 + 5, five times as long as broad, 4–9 gradually decreasing in length and increasing in thickness, 4 nearly twice as long as broad, 9 just transverse, 10–12 each a little longer than 9 and becoming a little thinner, 12 about quadrate, 13 less than half the thickness and considerably longer than 4, three times as long as broad, no segment ciliate nor with a flattened or shining area beneath, antennae distally subspirally rolled. Propodeum with dorso-lateral margin of valve-plate obtuse; length of fore-wing 8·5 mm.; hamuli 8. Posterior margins of sternites 4–6 hardly membranous; sternite 7 flattened. Genitalia (fig. 59; ninth sternite fig. 60) with the proximal part of the digitus relatively large and the distal membranous part narrow, the cuspis with short dense recurved bristles. Aedeagus with 12 teeth beneath.

Mischocyttarus barbatus var. **barbatus** var. n.

♀. Black; most of mandibles, ventral margin of clypeus, inner orbits to middle of eye-emargination, dorsal half of outer orbits, keel and posterior margin of pronotum, post-tegulae, anterior third of postscutellum and marks on its lateral lobes, small spots on each side of propodeal furrow ventrally, most of orifice and valve-plates, small spot at top of prepectus, dorsal stripe on mid and hind coxae, distal mark on all femora, narrow, posterior bands on tergites 1–2, lateral, posterior marks on sternites 1–2, *yellow*. Antennae 2–3 and 10–12 beneath, ventral angle of pronotum, spots on ventral halves of meta- and mesopleura and at top of prepectus, posterior margin of mesosternum, more or less extensive ventral suffusions of coxae, anterior surface of mid femora, dorsal surface of hind femora, tibiae (except a posterior streak on fore and mid, distal suffusion on hind), fore tarsi and mid and hind basitarsi, *ferruginous*. Tegulae pale testaceous, more or less darkened proximally. Wings moderately infuscate, especially along the costa.

Dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 10·0, 10·0, 10·5 mm.; hamuli 7, 7, 8.

♂. Resembles the female except in the following particulars :—proximal half of mandibles black, sides of clypeus rather narrowly yellow, postscutellum only very narrowly yellow, coxae not yellow marked, femora with no distal yellow marks, abdominal tergite 3 with an indistinct posterior, yellow, band, sternites without bands. Antennae 2–3 black, 8–13 yellow beneath. Ferruginous marks of thorax and legs much reduced but mesosternum with small spots beneath the fore coxae.

Specimens examined :—Colombia : Cordillera occidental, Rio Aguacatal, 2000 m., type ♀ (*Fassl*) (B.); Tocoto, allotype ♂ (B.); Aguatal, 2 ♀ paratypes (B.).

Mischocyttarus barbatus var. **cisandinus** var. n.

♀. Resembles var. *barbatus* except in the following particulars :—scutellum with a narrow interrupted yellow band, no yellow spot at top of prepectus. Most of antennal flagellum beneath ferruginous. Length (H. + Th. + T1 + T2) 9·0 mm.

Dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 9·5 mm.; hamuli 9; abdominal petiole considerably shorter, but still a little longer than hind femur, spiracular ratio hardly 1.

Specimen examined :—Colombia : Bogota, type ♀ (*Lindig*) (B.) [det. as *M. rufidens* (Sauss.) by Ducke].

This species has some resemblance to *M. hirsutus* sp. n. but apart from the shorter malar space, the propodeal furrow is much deeper and the first abdominal tergite longer. *M. cassununga* (R. von Iher.) has the pronotal keel reflexed and the first tergite much shorter and broader. The species which I am interpreting as *M. confirmatus* Zikán has the first tergite considerably shorter and broader.

Mischocyttarus confirmatus Zikán, 1935 : 164.

Colour pattern described under the varieties.

♀. Surface of head and thorax covered with moderately close very short appressed pale pubescence, only longer and outstanding on ventral half of clypeus; legs and abdomen with dense pale microscopic pubescence, tibiae and tarsi also with some very inconspicuous bristles; abdominal petiole with rather short not very abundant outstanding pubescence beneath, other sternites with short pubescence. Length (H. + Th. + T1 + T2) 9·5 mm.

Structurally very close to *M. barbatus* sp. n. and only differing as follows :—pronotal keel with the raised parts occupying more like lateral thirds, sharper-edged, not recurved (as it is in *M. cassununga* (R. von Iher.)), the keel in dorsal view just concave anteriorly. Sculpture of thorax a little finer and propodeal furrow somewhat narrower and better defined (as in *M. cassununga* (R. von Iher.)), dorso-lateral margin of valve-plates obtuse. Length of fore-wing 9·0, 9·0, 9·5 mm.; hamuli 8, 8, 9; abdominal petiole as long as hind femur, parallel-sided to spiracles, thence regularly and rather strongly diverging (scarcely contracting again), spiracular ratio 1 or a little greater, spiracles moderately projecting.

♂. Pubescence as in female, but shorter and sparser, on face below antennae dense and silvery, less conspicuous beneath abdominal petiole, dense but short on sternite 7. Length (H. + Th. + T1 + T2) 8·0 mm.

Structurally very close to *M. barbatus* sp. n. and only differing as follows :—antennal segment 13 shorter, hardly as long as 4, two and a half times as long as broad; pronotum and propodeum as in the female; length of fore-wing 8·0 mm.; hamuli 9; abdominal petiole as long as in female but less narrowed proximally, much shorter and considerably broader than in *M. barbatus*, spiracular ratio hardly 1, spiracles hardly at all projecting. Genitalia (fig. 61) with the digitus small and the membranous process very narrow. The bristles of the cuspis are short and weak. The aedeagus has 14 teeth beneath.

Mischocyttarus confirmatus var. **cearensis** var. n.

♀. Black; inner orbits to middle of eye-emargination, outer orbits, pronotal keel and posterior margin, moderately large spots on each side of front of scutellum and on its axillae, anterior half of postscutellum and its lateral lobes, large, suboval spots on each side of whole length (not quite reaching postscutellum) of propodeal furrow, orifice and valve-plates, small spots at tops of prepectus and metapleuron (sometimes also at bottom of metapleuron and postero-ventral corner of mesopleuron), dorsal stripe on mid and two dorsal stripes on hind coxae, distal spot on all femora, rather narrow, posterior bands of tergites and sternites 1–5, *pale yellow*. Most of mandibles and clypeus, antennal segment I (except rather indefinite dorsal cloud), 2–12 beneath, ventral angle of pronotum, anterior stripe on fore tibiae, *erruginous yellow*. Tegulae testaceous, darker proximally. Wings not or very little infuscate. Dorso-lateral margin of valve-plate of propodeum obtuse. Length of fore-wing 9·0, 9·0, 9·5 mm.; hamuli 8, 8, 9.

♂. Black; mandibles (except a proximal cloud), face below antennae (except ferru-

ginous dorsal mark on clypeus), inner orbits to centre of eye-emargination, outer orbits and malar space, antennae beneath, pronotal keel, posterior margin and ventral angle, two large, anterior spots on scutellum and on its axillae, anterior half of postscutellum and its lateral lobes, large, outwardly curved stripes on each side of propodeal furrow, valve-plates and most of orifice, spot at top of prepectus, large antero-discal area of mesosternum, fore and mid coxae beneath, one dorsal stripe on mid and two on hind coxae, anterior streaks on all femora, rather narrow posterior bands on tergites 1–5 and sternites 1–6, *pale yellow*. Fore tibiae *ferruginous* anteriorly. Tegulae brown, proximally pale yellow. Wings almost hyaline. Dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 8·0 mm.; hamuli 9.

Specimens examined:—Brazil: Ceará, Serra de Baturité, 600 m., 27.vii.1908, type ♀, allotype ♂ (*A. Ducke*) (B.M.) [det. by Ducke as *M. rufidens* (Sauss.)], Fortaleza, 2 ♀ (*F. D. da Rocha*) (J.B.).

Mischocyttarus confirmatus var. *confirmatus* Zikán, 1935 : 164.

No specimens of this form, described from Rio de Janeiro, Itatiaya, 10 ♂, have been available. The specimens described above as var. *cearensis* agree closely with his description (and run down to this species in his key) except for the colour-pattern. According to the description, var. *confirmatus* lacks the large yellow spots on the propodeum and the yellow mesosternum in the ♂, while there are fewer pale bands on the abdomen.

Zikán (1935 : 164–5) describes a nest found attached to the upperside of a leaf at about 3 m. from ground on an orange-tree in a thick wood near Rio de Janeiro. The cells were empty and the queen had left, but ten males were present. The nest was dark brown, the comb forming an irregular longish hexagon as in *M. ater* (Oliv.). Four sides were fairly straight, while the last-built sides were irregular. The petiole was short and broad and eccentric. The comb consisted of 11 rows of in all 78 cells, 4 rows having 9 cells each. An Ichneumonid was caught flying round the nest and two more emerged later.

Mischocyttarus cassununga (R. von Ihering).

Polybia cassununga R. von Ihering, 1903 : 146.
Mischocyttarus cassununga Ducke, 1918 : 352.
M. imitator Zikán, 1935 : 180 *nec* Ducke, 1904 : 362.

♀. Black; most of mandibles, ventral margin of clypeus, inner orbits to bottom of eye-emargination, dorsal and ventral third of outer orbits, pronotal keel (sometimes very obsoletely) and posterior margin very narrowly, small spots on axillae and post-tegulae, sometimes narrow anterior margin of postscutellum and its lateral lobes, usually most of orifice and valve-plates, usually small spot at top of prepectus, posterior margin of meso- and metasternum, ventral side of fore and mid coxae, dorsal and ventral stripes on hind coxae, anterior stripe on fore and anterior and posterior stripes on mid and hind femora, tibiae (except more or less distinct dorsal stripe), tarsi (except most of dorsal surface of mid and hind), abdomen often with narrow posterior bands on tergites 1–2 and 3 laterally, and always with broader, bi-emarginate, posterior bands on sternites 2–4, *yellow* to light *yellow-brown*. Antennae 4–12 beneath and ventral angle of pronotum more or less *ferruginous*. Tegulae brown, darker proximally. Wings hyaline, costal and subcostal cells and pterostigma amber-yellow. Surface of head, thorax and propodeum with sparse, inconspicuous, pale, appressed pubescence, longer and outstanding on ventral half of clypeus; legs and abdomen with close, appressed, microscopic, greyish pubescence, abdomen a little more shining than in allied species, tibiae and tarsi also with inconspicuous bristles; abdominal petiole beneath with rather sparse, outstanding, pale pubescence, other sternites with short pubescence, which is longer, outstanding and reddish on 5–6. Length (H. + Th. + T1 + T2) 8·0–9·0 mm.

Structurally very close to *M. barbatus* sp. n. and *M. confirmatus* Zikán but differing as follows :—punctures of thorax and propodeum finer than in *M. barbatus* sp. n. (about as in *M. confirmatus* Zik., very distinct and close on propodeum); pronotal keel sharp-edged on lateral thirds (as in *M. confirmatus* Zik.) but at extreme sides more raised and distinctly though not strongly reflexed, keel in dorsal view a little anteriorly concave; propodeum with the furrow very narrow and sharply defined (at bottom only one-third as broad as long), central keel often almost obsolete, dorso-lateral margin of valve-plate obtuse (31 spec.), subacute (25 spec.) or acute (3 spec.); length of fore-wing 9·0–11·0, average 9·8 mm.; hamuli 7–11, average 8·4; abdominal petiole nearly as in *M. confirmatus* Zikán but diverging from a little before spiracles, not at all contracted again before posterior margin, spiracular ratio about 1, spiracles not at all projecting.

♂. Resembles the female except in the following particulars :—whole mesosternum yellow; tarsi almost entirely yellow; antennal segment 1 yellow beneath; clypeus with appressed silvery pubescence; sternite 7 with short outstanding pubescence; length (H. + Th. + T1 + T2) 8·0 mm.

Mandibles unpunctured, ventral margin more sinuate; malar space more completely obliterated; clypeus dull, almost unsculptured, ventral margin less produced but still obtusely angular rather than curved; tentorial pits closer to eyes, which are in contact with clypeus for a longer distance; POL : OOL = 2 : 3; occiput behind the eyes dorsally hardly one and a half times POL; tempora one-third width of eye. Antennae with segment 3 as long as 1 + 2, a little longer than 4 + 5, about five times as long as broad, 4–9 gradually decreasing in length and increasing in thickness, 4 nearly twice, 9 once as long as broad, 10–12 each about as long as 9 but becoming progressively a little thinner, 13 less than half the thickness and not quite as long as 4, no segment ciliate nor with a shining area beneath, antennae distally subspirally rolled; propodeum with dorso-lateral margin of valve-plate obtuse (2 spec.), subacute (2 spec.) or acute (2 spec.); length of fore-wing 9·5–10·0, average 9·8 mm.; hamuli 6–9, average 7·8. Posterior margin of sternites 4–6 hardly reflexed, sternite 7 flattened. Genitalia resemble those of *M. barbatus* sp. n. in the proximally broad, distally narrowed digitus and in the short dense bristles on the cuspis but the parameral spine has longer bristles. The aedeagus has 16–17 teeth beneath.

Specimens examined :—Brazil: Espirito Santo, ♀ (*Fruhstorfer*) (B.), Porto do Cadi, iii.1921, ♀ (*F. Hoffmann*) (D.E.I.); Rio de Janeiro, near Rio, vii.–viii.1923, 2 ♀ (*W. S. Bristowe*) (O.W.R.), Rio, 4.i.1906, ♂ (*A. Ducke*) (B.M.), Gavea, 4.viii.1923, 3 ♀ (*H. Cott*) (B.M.), Petropolis, serra, 27.vii.1923, ♀ (*H. Cott*) (B.M.), Lagoinha, 23.vii.1923, ♀ (*H. B. Cott*) (B.M.), Itatiaya, 700 m., 18.viii.1932, ♀ (*J. F. Zikán*) (J.B.) [paratype of *M. imitator* Zik.], 18.ii.1932, 3 ♂, 21.ii.1932, ♂, 6 ♀ (*J. Zikán*) (D.E.I.); Minas Gerães, Cordisburgo, 7–8.xi.1919, ♀ (C.); São Paulo, Itatibia, ♀ (B.M.), S. Paulo, acclimação, 10.vii.1923, 3 nests with 9, 9 and 14 ♀ (*H. Cott*) (B.M.), Sto. Amaro, ix.–xii.1921, 5 ♀ (D.E.I.), 3 ♀ (B.); Sta. Catharina, ♂ (*Esch.*) (B.); state uncertain, Costancia, i.1857, ♀ (*H. Clark*) (B.M.).

This species is very closely allied to the two last, but, apart from the small structural differences, it is very constant in its colour-pattern.

Zikán (1935) separates his *M. imitator* principally because of the nature of its nest; the small morphological differences he mentions do not seem to me to be of specific value. The different nature of the nests is extremely remarkable but the matter is clearly in need of further study; the three females (above) from Gavea are associated with a nest of the same type as that of *M. imitator*.

Some notes on the structure of the larva will be found on p. 356.

R. von Ihering (1903 : 46), in his original description of the species, gives a brief description of the nest and also one in (1904 : 265).

Ducke (1907 : 188–9) records this species from the States of Espirito Santo, Minas Gerães, Rio de Janeiro and S. Paulo, all in the south. He notes its

resemblance to *Gymnopolybia vicina* (Sauss.) and *Polybia fastidiosuscula* (Sauss.) var. *buyssoni* (von Iher.). He states that it has a certain preference for fixing the eccentric petiole of its comb to the underside of the leaves of *Fourcroya*. Zikán (1935 : 182–3, pl. 1, fig. 5) found this one of the commonest species near Rio de Janeiro, with a preference for windows and walls of houses, only exceptionally nesting on leaves of low bushes. The name " Cassununga " is popularly applied to the fierce *Gymnopolybia* which makes huge nests. The largest nest of *M. cassununga* had 295 cells in 18 rows. On it was placed eccentrically a new nest of 39 cells. The larger one had been deserted the previous year and the small one had 5 wasps on it. The nests are very variable in shape, orientation of comb to surface and colour. The petiole is usually at the edge of the comb where the first cells were made, usually very thin but occasionally flat and broad as in *M. ater* (Oliv.). One nest on the underside of an orange-leaf was elongate and irregular as in *M. declaratus* Zikán but this type is probably an adaptation to its surroundings. The orientation of the comb to the surface to which the petiole is attached probably depends on whether it is attached to a vertical surface or to the angles of a horizontal surface. The colour of the comb in one locality may be light or dark grey or light or dark brown.

Zikán (: 181, pl. 1, fig. 1) also describes the unique nest of his *M. imitator* of which the adult appears to be hardly distinct from *M. cassununga* (R. von Iher.). The comb was attached by a short pedicel to a dry twig of a Coffee-bush, about 3 m. from the ground. The comb was 28 cells long and, at the widest near the petiole, only 5 cells broad, so that it is very much more elongate than in the normal form. One male and fifteen females sat on the comb.

I have examined five nests, nos. 411–413, Brazil : São Paulo, Acclimçaó, 10.vii.1923 (*H. Cott*) (B.M.); no. 414, Rio de Janeiro, Gavea, 4.viii.1923 (*H. Cott*) (B.M.); no. 415, Petropolis, Serra, 27.vii.1923 (*H. Cott*) (B.M.).

No. 412 is light reddish-brown, made of small elongate or oval flattened wood-particles, with a considerable amount of varnish. The petiole is 4·0 × 2·0 × 1·5 mm. and very heavily grey-varnished. The thin attachment plate is nearly circular, 6·0 × 7·0 mm., with small buttresses on all sides. The slight flattening of the petiole is in the direction of the shorter rows of cells. The cone of attachment is rather well developed. The cells form rows in three directions, firstly 15 short rows, 3, 5, 6, 7, 8, 8, 7, 7, 6, 5, 5, 5, 4, 3, 2 = 81 cells; also in two directions oblique to the short rows, in each of which there are ten longer rows. Of the fifteen rows, the petiole is attached to the centre of the tenth row (*i.e.*, not very eccentric). Completed cells are somewhat irregularly scattered about so that the distal surface of the comb is irregular. The proximal surface of the comb forms a very shallow cone for 7·0 mm. all round the petiole and outside this is flat. The comb is 41·0 × 21·0 mm.

The cells (when examined in 1940) contained relatively few larvae but many eggs; probably a good many of the cells were being used a second time. The eggs are attached 4·0–5·0 mm. from the bottom of the cell. Completed cells are 11·0 × 3·5 mm. and new cells are added all round. The cocoon cap is domed, projecting 1·5 mm. beyond the cell; it is made of brown fibrous silk with a certain amount of carton on it and overlapping its periphery.

Six cells in the centre have their walls damaged—broken down or pierced—and contain altogether 15 empty Phorid puparia, 1–2 per cell, usually 2.

Two cells have a perfectly flat dead white silk cap 2·0–3·0 mm. below the rim of the completed or nearly completed cell. These were opened and one contained a fully developed Ichneumonid, the other mouldy Hymenopterous

larva. Two cells with eggs and one empty cell show remains of similar Ichneumonid cocoons.

Nest 411 is generally similar but the comb is much longer (as in *M. imitator* Zikán) 62·0 × 20·0 mm. There are 7 rows of 1, 22, 21, 19, 16, 12, 5 = 96 cells along the long axis. The distal surface of the comb is a little convex but a large central area is nearly flat except for the cocoons which are irregularly dotted about. The seven cocoons seem little domed and there are bands of carton over the cap, and the periphery is quite hidden by carton. The cells contained more larvae, mostly small, than eggs. Ichneumonids had emerged from two cells. Nest 413 has a comb 30·0 × 15·0 mm. which consists of five rows of in all 44 cells. Nest 414 had evidently been attached to a wall as there are grains of quartz and red earth on the attachment plate. The comb is very elongate, 27·0 × 10·0 mm., with 4 rows of 4, 7, 6, 6 = 23 cells. The two outer rows are mainly of small cells. The petiole is attached to the end cell of an outer row (*i.e.* very eccentric). Nest 415 is a smaller nest with a comb of 4 rows of 1, 4, 4, 2 = 11 cells. The petiole is attached to the second cell of one of the rows of four. The cells were mostly complete.

It would appear that nest 415 is a nest constructed by one female just before the emergence of the first brood of workers. In the other nests, workers have been present for some time and many of the cells have been cleaned out and are being used again.

Brauns (1905 : 130) described an Ichneumonid, *Mesostenus cassunungae*, bred from Brazilian (S. Paulo district) nests of the present species. An immature ♂ of this parasite was extracted from a cocoon in nest 412.

Mischocyttarus paraguayensis Zikán, 1935 : 165.

♀. Yellow, black markings rather sharp-edged, but becoming browner on abdomen; mandibular teeth and actual ventral margin of clypeus dark, other clypeal sutures not (or hardly), supraclypeal plate not black-marked; antennae black to dark brown, segments 1–2 yellow beneath, 3–12 blackish to yellow-brown beneath; black ocellar mark nearly reaching antennal sockets but in 9 out of 12 spec. becoming brown anteriorly, mark very broad posteriorly with no (10 spec.) or small (2 spec.) lateral " wings," occiput with moderately broad black line, broadly connected with ocellar mark with black streak along dorsal quarter of posterior orbits; pronotum in front of keel with central dark brown spot and some reddish-brown suffusions on each side, dorsal lobes with black stripes which are broader in front than behind; mesonotum black with narrow yellow lateral stripes opposite the tegulae and two central yellow stripes separated by one and a half to twice their width; scutellum with narrow central line, anterior and posterior border black and a large black (or in 2 spec. brown) triangle (covering more than half its surface) not quite based on posterior border; postscutellum with a more or less triangular black mark covering its posterior half (7 spec.) or (5 spec.) a narrow posterior black border; propodeum with narrow central stripe, no or (4 spec.) faint brown antero-lateral triangles, and spot at ventral ends of lateral furrows black; meso- (except ventrally) and metapleural sutures narrowly black-marked, black spot beneath root of fore-wing moderate, ventral half of prepectus, meso- and metasternum yellow; mid coxae with inner dorsal stripe and most of inner surface brown, condyle yellow (7 spec.) or (2 spec.) fuscous or black (1 spec.), femur with postero-dorsal and ventral dark stripes, tibia with dorsal stripe on proximal four-fifths, tarsus with all segments or last two or three darkened dorsally; hind coxa with mid dorsal dark stripe and condyle yellow (6 spec.) or mid dorsal and interrupted inner dorsal stripes and condyle black (6 spec.), femur with dorsal and ventral stripes, dorsal surface of tibiae and tarsus darkened; abdomen yellow ventrally, dorsally 1–2 red-brown, 3–5 black, posterior fifth of tergites 1–5 yellow, posterior boundary of dark parts nearly straight, tergite 6 yellow, sternites 3–5 with some

irregular dark marks. Tegulae yellow with large outer testaceous spot. Wings hyaline, very little infuscate, costal cell not yellow-tinged, venation and pterostigma brown. Surface of head, thorax and propodeum with sparse very short and inconspicuous appressed pale pubescence, some longer outstanding black bristles near ocelli, pubescence on ventral half of clypeus pale and outstanding; legs and abdomen with close appressed microscopic pale (or on black parts greyish) pubescence, abdomen about as dull as in *M. cassununga* (R. von Iher.), tibiae and tarsi also with rather sparse outstanding pale bristles; abdominal petiole at sides anteriorly and beneath with long, moderately abundant outstanding pubescence, other sternites with short pubescence, that on 5–6 longer, denser and outstanding. Length (H. + Th. + T1 + T2) 8·0–9·0 mm.

Structurally very close to *M. cassununga* (R. von Iher.) and *M. confirmatus* Zikán but differing as follows :—punctures on head and thorax about the same, but on propodeum clearly finer and shallower; pronotal keel very feebly anteriorly convex but lateral extremities not reflexed as in *M. cassununga* (R. von Iher.); propodeum with furrow considerably shallower and less well defined, extending almost to postscutellum where there is no semi-horizontal area, central keel more or less distinct, dorso-lateral margin of valve-plate acute (3 spec.), subacute (4 spec.) or obtuse (5 spec.); length of fore-wing 8·5–11·5, average 10·1 mm.; hamuli 8–10, average 9·3; abdominal petiole generally similar but broader anteriorly, more gradually widened posteriorly, actual width at posterior margin about the same, spiracular ratio hardly 1, spiracles a little though obtusely projecting.

♂. Resembles ♀ except in the following particulars :—antennae with segment 13 yellow-brown; tergites 1–6 blackish anteriorly or 1–2 brown (5 Chapada spec. and 1 Mbovevo spec.), 7 with small anterior black spot, sternites 3–6 irregularly dark-marked; clypeus with appressed silvery pubescence; sternites 5–6 with an anterior, tranverse band of semi-erect pubescence, sternite 7 with close, short, outstanding pubescence. Length (H. + Th. + T1 + T2) 7·5 mm.

Differs structurally from ♀ in same way as does *M. cassununga* (R. von Iher.) ♂ from its ♀; dorso-lateral margin of valve-plate of propodeum acute (1 spec.), subacute (2 spec.) or obtuse (4 spec.); length of fore-wing 9·0–11·0, average 10·3 mm.; hamuli 8–9, average 8·3; posterior margin of sternites 4–6 not reflexed. Genitalia very similar to those of *M. cassununga* (R. von Iher.) but aedeagus with 13 teeth beneath.

Specimens examined :—Paraguay : Mbovevo, 2 ♂, 6 ♀ (*F. Schade*) (J.B.) [1 ♀ compared with type by J.B.]; Villa Rica, x.1933, ♀, no date, ♀ (*F. Schade*) [det. J. Zikán] (J.B.), Sapucay, 8.iv.1903, ♀ (*W. T. Foster*) J.B.). Brazil : Matto Grosso, Chapada, 14–22.xii.1919, 3 ♀, 5 ♂ (C.).

This species is extraordinarily similar in colour to *M. alfkenii* (Ducke) var. *zikanii* var. n. and the females can only be separated with difficulty (see p. 400).

Zikán (1935 : 165–8, pl. 3, fig. 3) describes and figures the nest of *M. paraguayensis* from Mbovevo, Paraguay. The nest is said to be like that of *M. cassununga* with a thinner eccentric petiole of light grey colour, fastened to the underside of the mid-rib of a leaf. The comb consisted of 24 cells of which 9 were completed.

Group of *M. cubensis* (Sauss.) (text-figs. 63–9).

Characters of the adults given in the key (p. 308). The ♂ genitalia in *M. cubensis* (Sauss.) have the digitus (fig. 69) long, narrow and membranous, the cuspis with short not very numerous bristles and the parameral spine with long bristles. The aedeagus has 13 teeth. The following forms of this group were examined but appeared to differ from *M. cubensis* in insignificant details only; the number of teeth on the aedeagus is given in brackets. *M. angulatus* sp. n. var. *columbianus* var. n. (13), *M. alfkenii* (Ducke) (12), *M. alfkenii* var. *zikanii* var. n. (11), *M. phthisicus* (Fab.) (12).

Larva. Since Reid's paper was published I have examined dried larvae of *M. angulatus* sp. n. They certainly have two ventral lobes on the first abdominal sternite but nothing else can be made out.

Nest. Not very much information is available. The petiole is little flattened and usually eccentric except in some of the largest nests.

Ducke's ideas on the synonymy of this group were published in (1913). In effect he recognises one species with several varieties. Except perhaps with regard to *M. phthisicus* (Fab.), this course would not be wholly incorrect, but it would make it very difficult to describe the geographical variation.

Mischocyttarus cubensis (Saussure).

Polybia cubensis de Saussure, [1854 : 202].

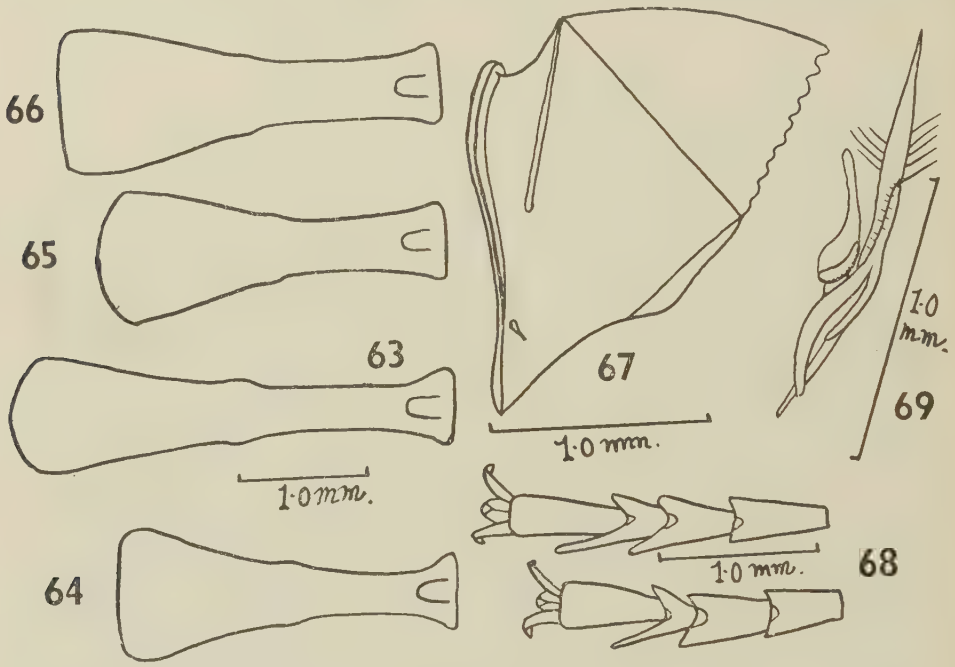
Colour-pattern described under the varieties.

♀. Surface of head and thorax with short, not very close, appressed, pale pubescence, that on clypeus bristle-like and outstanding on ventral third; legs and abdomen with dense, microscopic, appressed, pale pubescence, tibiae and tarsi also with inconspicuous, reddish bristles; abdominal petiole beneath with short, sparse, outstanding pubescence, other sternites with appressed pubescence, except 5–6 where it is outstanding and rather dense. Length (H.+ Th. + T1 + T2) 9·0–10·0 mm. (according to Bequaert (1933) 8·0–11·0 mm.).

Head dull, so closely and finely punctured that it appears granulate, only ventral quarter of clypeus with some irregular, large punctures. Mandibles shining, with a few, shallow, large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest about one-third (rather more or less) as long as width of antennal socket. Width of clypeus where eyes approach most closely a very little greater than its length, ventral quarter a little depressed, ventral margin with central two-thirds angularly but not very strongly produced. Tentorial pits about equidistant from eyes and antennal sockets, well removed from both. Antennal sockets hardly farther from one another than from eyes. Antennal segment 3 a little shorter than 1. Eyes very little closer ventrally than dorsally, just in contact with clypeus at a point. Ocelli of moderate size, in an equilateral triangle, separated from one another by fully one and a half times the diameter of one, POL : OOL about 1 : 2. Occiput not margined, its width behind the eyes dorsally not quite twice the POL. Tempora two-thirds width of eye. Thorax + propodeum twice as long as broad, dull (even mesopleuron absolutely dull), with very close, fine, subgranulate punctures. Pronotum with anterior margin well raised but not reflexed, preceded by a distinct furrow the posterior margin of which is usually quite obtuse, rarely a little acute; lateral fovea rather strong; keel continuous but absolutely obtuse throughout, in dorsal view very slightly convex anteriorly. Proepisternum with anterior margin not raised or reflexed, sides feebly margined. Mesopleuron with the anterior margin of the hollow beneath the root of the fore-wing tubercle-like ventrally, not produced dorsally; prepectal and ventral furrows almost obsolete, dorsal furrow moderate. Upper division of metapleuron not produced along the meso-metapleural suture. Tegulae dull, very finely granulate, lateral margin in an almost regular curve. Postscutellum moderately flattened but its anterior margin not in same plane as scutellum. Propodeum with almost no anterior horizontal region, central furrow broad, shallow, very ill defined, extending about three-quarters of its length, central keel usually nearly or quite obsolete, lateral furrows just traceable. Mid tibia with two spurs of equal length. Mid tarsi with segment 3 quite distinctly asymmetrical, segment 4 strongly produced. Hind tarsi with the inner lobe of segment 3 much more produced than the outer lobe of segment 4, the outer edge of which is about two-fifths as long as its inner edge; segment 5 about as long as 2, claws strongly asymmetrical, larger claw rather blunt. Abdominal petiole as long as hind femur, parallel-sided to spiracles, thence at first rather strongly diverging but soon becoming more

nearly parallel (though actually still diverging) again, posterior about two and a quarter times as broad as anterior margin, spiracular ratio 4 : 5, spiracles usually very little projecting; petiole ventrally with membranous emargination more than four times as wide as deep. Tergite 2 strongly expanded, as long or rather longer than broad.

♂. Resembles the ♀ except in the following particulars :—all pubescence of clypeus short though not very dense and silvery; sternite 7 with moderately close, short pubescence; length (H. + Th. + T1 + T2) 8·0–10·0 mm. Dorsal part of head rather more finely sculptured; mandibles unpunctured, more flattened, dorsal teeth smaller; clypeus more



Figs. 63–9.

Fig. 63. Dorsal view of abdominal tergite 1, *M. angulatus* sp. n. ♀.
64. The same, *M. costaricensis* sp. n. ♀.
65. The same, *M. basimacula* (Cam.) ♀.
66. The same, *M. alfkenii* (Ducke) ♀.
67. Dorso-lateral view (left) of pronotum, *M. basimacula* (Cam.) ♀.
68. Left mid and hind tarsi, *M. alfkenii* (Ducke) ♀.
69. Ventral view of left volsellar plate and parameral spine, *M. cubensis* (Sauss.) ♂.

flattened, hardly depressed ventrally, margin much less produced in a gentle curve; tentorial pits nearly twice as near to eyes as to antennal sockets; eyes in contact or nearly in contact with clypeus along about half its sides; occiput narrower behind eyes dorsally, its width sometimes only one and a half times POL; tempora half width of eye; antennae with segment 3 as long as 1 + 2, a little longer than 4 + 5, four and a half times as long as broad, 4–10 gradually decreasing in length and increasing in thickness, 4 not quite twice, 10 rather less than once as long as broad, 11–13 becoming a little thinner, 11 and 12 about as long as 10, 13 as long as 6, one and a half times as long as broad, segments 3–13 beneath with slightly raised areas which are a very little more shining, that on 3 very elongate, others becoming broader on each succeeding segment, antennae not spirally rolled, only a little curved posteriorly; posterior margin of sternites 4–6 membranous but not recurved sternite 7 flattened. Genitalia fig. 69.

Mischocyttarus cubensis var. *cubensis* (Sauss.).

♀. Head *ferruginous*, mandibles, orbits broadly, sides and ventral margin (sometimes nearly whole of) clypeus, two spots just above antennae, sometimes oblique lines from orbits to centre of occiput (behind ocelli), *pale yellow* (region just above clypeus and disc of vertex sometimes blackish suffused). Thorax and propodeum *ferruginous* to *black*, dorsal part of pronotum, mesonotum and scutellum remaining more or less ferruginous in darkest specimens; ventral angles, keel and collar of pronotum, often two discal lines on mesonotum, anterior half of scutellum (boundary straight) and its axillae, post-tegulae, anterior two-thirds of postscutellum and its lateral lobes, two large spots on each side of propodeal furrow extending from orifice two-thirds to three-quarters distance to postscutellum, orifice and valve-plates, spot at top of prepectus, sometimes postero-ventral spot on mesopleuron, greater part of dorsal division of metapleuron and sometimes a spot on its ventral division, often irregular marks on proepisternum, ventral mark on fore coxae, sometimes dorsal and ventral marks on mid coxae, sometimes two dorsal stripes on hind coxae, distal marks on all femora and sometimes anterior streak on fore femora, tibiae and tarsi (except distal third of hind tibiae), *yellow*. Abdomen *ferruginous* or *dark ferruginous*, first tergite sometimes proximally *black*, tergites 1–4 and sternites 1–3 with rather narrow *yellow* bands. Tegulae yellow, hardly at all testaceous even proximally. Wings hyaline with costal and subcostal cells (sometimes whole anterior half) and pterostigma yellow-brown, radial cell a little infuscate. Dorso-lateral margin of valve-plate of propodeum acute (12 spec.), subacute (1 spec.) or obtuse (1 spec.). Length of fore-wing 8·5–11·0, average 9·8 mm.; hamuli 8–13, average 10·2.

♂. Resembles the ♀ except in the following particulars:—Face below centre of eye-emarginations almost entirely yellow; more or less extensive area on mesosternum beneath fore coxae yellow; femora more extensively yellow, with small dorsal proximal marks as well as larger distal ones; propodeum with dorso-lateral margin of valve-plate acute; length of fore-wing 8·5–10·0, average 9·0 mm.; hamuli 9–11, average 10·0.

Specimens examined:—U.S.A.: Florida, Dunedin, 30.i.1932, ♀ (*A. L. Melander*) (D.E.I.), Key Largo, 25.i.1932, ♀ (*A. L. Melander*) (D.E.I.), Silver Spring, 2.iv.1932, ♀ (*A. L. Melander*) (D.E.I.), Fort Lauderdale, 3.vii.1933, ♀ (*M. Bates*) (D.E.I.), Orlando, 26.v.1937, bred ♂ (*R. Dow*) (J.B.), Lower Metecumbe Key, 19.v.1937, ♀ (*R. Dow*) (J.B.), Coconut Grove, 28.ii.1924, small nest on palmetto, ♂, 4 ♀ (*G. B. Pearson*) (B.M.), St. Johns Bluff, 2 ♀ (*E. Doubleday*) (B.M.). Cuba: mountains nr. Guantánamo, ♂♀ (P. Cameron coll.) (B.M.) [det. by Cameron as *Polybia fasciata*], Camogüey, 20.viii.1924, ♂ (*J. Acuña*) (J.B.), Camagüey, Baragua, 20.vi.1932, ♀ (*Bates and Fairchild*) (J.B.). No data: ♀ (E. Smith coll.). (B.M.).

In the Muséum national, Paris, I examined ♂, 2 ♀, Cuba, 1838 (Guérin) which are mentioned by Saussure in his original description. I determined that they belonged to the present species, but did not study them more closely. They were mixed with *P. indeterminabilis* Sauss. (= *M. phthiscus* (Fab.)).

Bequaert (1933) further records *M. cubensis* Sauss. from Georgia and the Bahamas (see below).

Mischocyttarus cubensis var. **maculipes** var. n.

♀. Resembling one of the darkest specimens of var. *cubensis* (Sauss.) and also differing as follows:—only anterior third of postscutellum yellow, yellow spots on each side of propodeal furrow covering less than half its length, metapleuron black, coxae black (except a minute yellow spot on dorsal side of hind), mid and hind femora black, distal half of mid tibiae and distal two-thirds of hind tibiae, black; abdomen with rather distinct yellow bands on tergites 1–6 and sternites 2–4, sternite 1 also yellow on each side posteriorly;

tegulae testaceous except for a posterior yellow spot; wings less infuscate distally; length (H. + Th. + T1 + T2) 10·5 mm.; pronotal fovea strong; dorso-lateral margin of valve-plate of propodeum only acute for a short piece close to orifice; length of fore-wing 10·5 mm.; hamuli 13.

Bahamas: type ♀ (*Prof. Plate*) (B.).

I suspect that this may prove to be a geographical race. Bequaert (1933 : 140) mentions two specimens from the Bahamas but does not note that they differed from the ordinary form; it is possible, nevertheless, that they did so.

Mischocyttarus cubensis var. *mexicanus* (Saussure).

Polybia mexicana Saussure, [1854]: 203.
Mischocyttarus rufidens du Buysson, Ducke, *in part*, ? not of *Polybia rufidens* Saussure, [1854] : 204.

♀. Differs from var. *cubensis* (Sauss.) as follows :—head with supraclypeal plate, disc of vertex (including ocelli and sending a process into eye-emarginations), excluding two small spots above antennal sockets, *black*; under surface of head always black; other parts *yellow* except that disc of clypeus is *ferruginous*; antennae ferruginous, more or less completely black above; thorax with mesonotum and propodeum usually with black ground-colour, mesonotum with or without yellow discal stripes, yellow stripes on propodeum complete, no yellow mark on ventral division of metapleuron, often only a very small one at postero-ventral corner of mesopleuron; fore coxae black except yellow distal extremity (rarely entirely yellow beneath); mid coxa with only dorsal stripe; hind coxa always with two dorsal stripes; anterior and mid femur with anterior and posterior stripes, hind femur with posterior stripes (rarely also with anterior ones), distal marks on all femora yellow; tibiae and tarsi ferruginous, distal marks on fore and sometimes on mid tibia yellow, distal third of hind tibia, last three segments of hind tarsi, blackish; abdomen with tergites 1–3 (rarely 1–2) and sternites 2–3, with yellow posterior bands, sternite 1 entirely and often sides of tergite 1, yellow; tegulae testaceous with inner yellow stripe; wings nearly hyaline with yellow-brown venation; length (H. + Th. + T1 + T2) 8·0–11·0 mm.

Eyes in contact with clypeus for longer distance; posterior margin of furrow preceding anterior margin of pronotum usually obtuse, sometimes nearly a right-angle; pronotal fovea usually strong; dorso-lateral margin of valve-plate of propodeum acute (3 spec.), subacute (7 spec.) or obtuse (9 spec.); length of fore-wing 9·0–11·5, average 10·2 mm.; hamuli 8–12, average 10·0.

♂. Resembles ♀ (apart from usual sexual differences); clypeus more yellow; mesosternum with two large yellow anterior spots on each side; fore coxae entirely, mid coxa considerably, yellow beneath; dorso-lateral margin of valve-plate of propodeum acute (2 spec.), subacute (2 spec.) or obtuse (1 spec.); length of fore-wing 10·0–10·5, average 10·1 mm.; hamuli 9–12, average 10·4.

Specimens examined :—U.S.A. : Texas, Hidalgo Co., 11.iv.1935, ♀ (J.B.). Mexico : Tamaulipas, Victoria, ♀ no. 1370 (*P. Rau*) (J.B.); Morelos, Cuernavaca, vi., ♀ (*H. H. Smith*) (B.M.); Guerrero, Venta de Zopilote, 2800 ft., vi., 2 ♀, x., 2 ♀ (*H. H. Smith*) (B.M.), Tierra Colorada, 2000 ft., x., ♂ (*H. H. Smith*) (B.M.), Amula, 6000 ft., ix., ♀ (*H. H. Smith*) (B.M.), Acaquizotla, 1500 ft., x., ♂ (*H. H. Smith*) (B.M.), Dos Arroyos, 1000 ft., ix., ♀ (*H. H. Smith*) (B.M.); Oajaca [Oaxaca], 1903, 4 ♀ (coll. R. du Buysson) (B.M.) [det. as *M. rufidens* (Sauss.)]; Vera Cruz, Cardel, La Gloria, vii.1937, ♀ (*J. Camelo*) (J.B.); N. Yucatan, ♀ (*Gaumer*) (B.M.); state unknown, Coatepec, ♀ (*J. Quiroz*) (B.M.), Huastec t.t., ♀ (F. Smith coll.) (B.M.), " Mexico," 3 ♂ (*O. A. Purpus*) (B.), ♀ (Wilson-Saunders coll.) (O.); no data, ♀ (D.E.I.).

In the above series are included specimens not only of *Polybia mexicana*

Sauss. but also some which have generally gone under the name of *M. rufidens* (Saussure, 1854). That species has been much misunderstood; it was described from Cayenne (coll. Spinola) and might possibly be the same as *M. duckei* (du Buysson). It is better left on one side until the type (presumably at Turin) has been re-examined; there is not even complete certainty as to its correct generic position. Ducke and du Buysson failed to recognise that there was a complex of species with a similar pattern and I have seen specimens labelled *M. rufidens* which belonged to *M. cubensis* (Sauss.) var. *mexicanus* (Sauss.), to *M. confirmatus* Zikán var. *cearensis* var. n., and to *M. pallidipectus* (Sm.). *M. immarginatus* Rich. (q.v.), also found in Mexico, is very easily mistaken for var. *mexicanus*.

The blackest forms of *M. cubensis* (Sauss.) var. *mexicanus* (Sauss.) at first sight look rather different from the more ferruginous ones but they intergrade completely.

In the Muséum national, Paris, I examined the type ♀ of *Polybia mexicana* Saussure—Mexique, 1844 (Giesbrecht)—and it agrees with the above interpretation.

Mischocyttarus cubensis var. **sternalis** var. n.

M. cubensis (Saussure) var. *mexicanus* Bequaert, 1933, *in part.*

♀. Head *yellow*; dorsal side of antennal segment 1, a large, U-shaped mark on vertex (including ocelli, but not sending a process into eye-emargination), narrow dorsal outer orbital stripe, broad band above the foramen, *black*; antennae 2–12 ferruginous, a little darkened dorsally. Thorax *yellow*; pronotum with transverse mark in front of keel, broad stripes on dorsal lobes, mesonotum (except two large discal stripes and two small stripes just inside tegulae), posterior half of scutellum and postscutellum (boundary of yellow and black straight on scutellum, slightly angled on postscutellum), propodeum with central furrow and antero-lateral, triangular spots, spot at top of prepectus and prepectal and dorsal furrows, meso-metapleural suture, line along metapleural-propodeal suture, inner-dorsal surface of mid coxa, dorsal stripe and inner surface of hind coxa, dorsal suffusions of mid and hind tibia and femur, dorsal side of hind tarsal segment 5, *black*. Abdomen (in bad condition) *blackish-brown*, posterior bands of tergites 1–2 and apparently most of sternites, *yellow*. Tegulae yellow with a large, outer, testaceous spot. Wings nearly hyaline, venation yellow-brown. Length (H. + Th. + T1 + T2) 9·0 mm.

Structurally like var. *cubensis* (Sauss.) except:—eyes in contact with clypeus for a rather longer distance; posterior margin of furrow preceding anterior margin of pronotum obtuse, fovea very small; dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 10·5 mm.; hamuli 9.

♂. Similar to ♀ (apart from normal sexual differences); head with disc of vertex either black with lateral processes entering the eye-emarginations (as in var. *mexicanus* (Sauss.)) or (in Costa Rica spec.) with the black area deeply, angularly emarginate anteriorly; antennae 2–10 or 2–12 darker above, nearly black; dorsal stripes of pronotum sometimes partly or entirely ferruginous; mesonotum with only narrower discal stripes yellow; posterior two-thirds of scutellum black or black and ferruginous; lateral, dark triangular of propodeum more or less fused with the broader black stripe along metapleural-propodeal suture and with stripe in central furrow; dorsal area behind dorsal furrow of mesopleuron black; black marks of legs reduced; abdomen dark reddish-brown, sides and posterior margin of tergite 1 (more or less distinctly) and sternites almost entirely yellow. Tegulae testaceous with an inner yellow stripe. Length (H. + Th. + T1 + T2) 9·0–10·0 mm.; dorso-lateral margin of valve-plate of propodeum obtuse (1 spec.) or subacute (2 spec.); length of fore-wing 10·0 mm.; hamuli 10, 10, 11.

Specimens examined :—Mexico : Guerrero, Acaguizotla, 3500 ft., x., ♂ type (*H. H. Smith*) (B.M.), no locality, ♀ allotype (*Ehrenberg*) (B.). Paratypes : Mexico : Guerrero, Tierra Colorado, 2000 ft., x., ♂ (*H. H. Smith*) (B.M.). Costa Rica : Ocloro, ♂ (*Alfaro*) (J.B.).

This form, which seems to occur mixed with the var. *mexicanus* (Sauss.), was treated by Bequaert (1933) as a form of that variety. In the rather limited material which I have examined, there is marked discontinuity between them. It bears a considerable resemblance to a dark form of *M. basimacula* (Cam.), but, apart from the characters given in the key, the mesopleuron is duller and more closely punctured than in that species.

Mischocyttarus cubensis var. **flavissimus** var. n.

♀. *Yellow*; dorsal streak on antennal segment 1, discal area of vertex (except an indeterminate, central, yellow spot), not much produced into eye-emargination but with small, lateral productions at level of posterior ocelli, occiput and oblique line from it to inner posterior corner of eye, three broad stripes on mesonotum, anterior and posterior margin of scutellum very narrowly, prepectal and dorsal furrows of mesopleuron, dorsal half of meso-metapleural suture, *black*; area on pronotum in front of keel, broad stripes on its dorsal lobes, posterior two-thirds of scutellum and half of postscutellum, central stripe, incomplete lateral stripes and anterior margin of propodeum, dorsal stripes on mid and hind coxae, some indefinite stripes on the femora, *ferruginous*; tibiae, tarsi and abdomen somewhat more ferruginous tinted. Tegulae yellow. Wings hyaline, costal area faintly and pterostigma yellowish. Length (H. + Th. + T1 + T2) 12·0 mm.

Structurally resembles var. *cubensis* (Sauss.) except :—eyes in contact with clypeus for a longer distance; posterior margin of furrow preceding anterior margin of pronotum obtuse, fovea perhaps a little smaller; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 11·5 mm.; hamuli 11.

Specimen examined :—Rep. Honduras : Porto Castilla, 27.iii.1924, type ♀ (J.B.).

Bequaert (1933 : 139, pl. 29, figs. 5 and 6) describes the nest of *M. cubensis* from Cuba. It was founded at the wooded swampy margin of a stream, hanging down from *Tillandsia*, six feet above the ground. The comb was nearly vertical with cells opening downwards. It was 28·0 × 21·0 mm., a little convex, of 37 cells, mostly incomplete. Four of the cells were capped over and these were 3·5 mm. across and 15·0, 13·0, 11·0 and 10·0 mm. long, respectively. The carton was pale brown and was made of flat pieces of plant-tissue, probably taken from leaves and not from wood. Four wasps, all alike in size and colour, were on the comb. Bequaert records the close resemblance in colour between *M. cubensis* and the Syrphid fly, *Salpingogaster punctifrons* Curran, in Cuba. Ashmead (1894 : 76) states that in Florida, *M. cubensis* builds nests attached to the twigs of orange-trees. Some of the specimens recorded on p. 383 from Florida were from a nest on a palmetto. Bequaert (1940) records that two females of the var. *mexicanus* (Sauss.) with their nest were found in a bunch of bananas at Holland, Bell Co., Texas.

Mischocyttarus angulatus sp. n.

♀. Colour pattern described under each variety. Pubescence as in *M. cubensis* (Sauss.) but bristles extend over ventral two-thirds of clypeus. Length (H. + Th. + T1 + T2) 8·0–10·0 mm.

Structurally similar to *M. cubensis* (Sauss.) except in the following particulars :—ventral margin of clypeus perhaps a little more produced, more angular; eyes in contact with

clypeus for a considerable stretch; POL : OOL nearer 3 : 5; posterior margin of furrow preceding anterior margin of pronotum obtuse, lateral fovea moderately strong, keel nearly always much stronger, especially lateral quarters which are quite strongly raised though not usually very acute, keel in dorsal view straight.

♂. Clypeus with short appressed silvery pubescence. Length (H. + Th. + T1 + T2) 9·0 mm.

Differing slightly from ♀ in same way as sexes of *M. cubensis* (Sauss.).

Mischocyttarus angulatus var. **angulatus** var. n.

♀. Yellow with sharp black markings, very rarely in part replaced by ferruginous; mandibular teeth, actual ventral margin of clypeus, tentorial pits black; supraclypeal plate with a minute dorsal spot (1 spec.), or a transverse dorsal line (7 spec.) or dorsal and central lines (2 spec.), black; ocellar area sending forward large black processes which are strongly (8 spec.), moderately (1 spec.) or slightly (1 spec.) produced into eye-emargination, processes strongly emarginate antero-internally, usually not enough produced inwards to enclose a spot (6 spec.) but in 4 spec. meeting to enclose three spots (*i.e.* anterior one divided by central line), at level of posterior ocelli with a short rounded process (" wing "), posteriorly with a narrow production to occiput; large occipital area and dorsal half of outer orbits black, connected at inner posterior corner of eye to occipital area; antennae more orange with segments 1–3 (7 spec.), 1–4 (1 spec.), 1–6 (1 spec.), 1–7 (1 spec.) dorsally black; broad mark in front of keel and broad stripes on dorsal lobes of pronotum, mesonotum (except two discal stripes, lateral stripes being absent), anterior fifth and posterior half of the scutellum (anterior margin of posterior black part always straight, in 1 spec. ferruginous not black), posterior third of postscutellum, black; propodeum with central stripe, antero-lateral triangles and broad lateral stripes black, two latter more or less widely (5 spec.) or just separated (3 spec.) or distinctly joined (2 spec.); mesopleuron with prepectal and dorsal furrows, prepectal spot at wing-roots, ventral prepectal spot (moderate, 3 spec.; small, 2 spec.; absent, 5 spec.), oval episternal mark above ventral furrow (moderate, 8 spec.; small, 1 spec.; absent, 1 spec.), the prepectal and episternal spots always widely separated, most of meso-metapleural suture, black; metasternum with black mark covering anterior half (3 spec.), quarter (1 spec.), fifth (1 spec.) or absent (5 spec.); mid coxa with dorsal black stripe, condyle yellow (7 spec.) or black (3 spec.); (hind coxa with dorsal and ventral stripes and inner side (entirely, 2 spec., dorsal two-thirds, 6 spec., dorsal third, 2 spec.) black, condyle yellow (5 spec.) or black (5 spec.); indefinite marks on all trochanters, dorsal stripe on all femora, ventral stripes on all mid and hind femora, dorsal stripes of fore and mid tibiae (except distal third), hind tibiae except anterior, posterior and ventral patches on distal quarter, most of hind tarsi dorsally, black; anterior three-quarters abdominal tergite 1, broad anterior bands of tergites 2–4 (posterior margin of bands more or less strongly sinuate), anterior two-thirds to four-fifths of tergite 5, tridentate mark on sternite 2 (arms of trident narrowly joined anteriorly, 8 spec.; arms not joined, 1 spec.; abdomen lost, 1 spec.), black. Tegulae testaceous with inner margin yellow. Wings hyaline, costal cell faintly yellowish, venation yellow-brown. Length (H. + Th. + T1 + T2) 8·0–10·0 mm.

Dorso-lateral margin of valve-plates of propodeum subacute (5 spec.) or obtuse (5 spec.); length of fore-wing 10·0–11·0, average 10·4 mm.; hamuli 7–11, average 9·1.

♂. Similar to ♀ except for normal sexual differences; dorso-lateral margin of valve-plate of propodeum obtuse (2 spec.) or subacute (5 spec.); length of fore-wing 10·0–11·5, average 10·4 mm.; hamuli 8–12, average 9·9.

In colour resembles ♀ but mandibles and clypeus entirely yellow; supraclypeal plate with minute black dorsal spot (6 spec.) or yellow (1 spec.); ocellar area sending forward large black processes which are strongly (6 spec.) or very little (1 spec.) produced into eye-emargination, processes emarginate antero-internally either moderately (3 spec.) or slightly

(4 spec.), not enclosing a spot; antennae with segments 1–3 dorsally black, and 4–5 or 4–6 brown (4 spec.) or not (3 spec.); propodeum with antero-lateral black triangles and lateral stripes widely separated (2 spec.), narrowly separated (1 spec.), just joined (1 spec.) or broadly joined (3 spec.); ventral black spot on prepectus moderate (3 spec.), small (2 spec.) or absent (2 spec.), spot on episternum moderate (4 spec.), small (2 spec.) or absent (1 spec.), these spots widely separated; metasternum with anterior black spot absent (2 spec.), one-quarter its length (3 spec.), one-third (1 spec.), once (1 spec.); mid coxal condyle yellow (4 spec.), fuscous (1 spec.) or black (2 spec.); hind coxa with inner side entirely (1 spec.), dorsal two-thirds (3 spec.), dorsal half (2 spec.) or dorsal one-third (1 spec.) black, condyle yellow (1 spec.), fuscous (1 spec.) or black (5 spec.); tarsi yellow; abdominal tergites usually with rather less black; tridentate mark on sternite 2 with arms narrowly joined anteriorly (3 spec.), just joined (1 spec.) or separate (2 spec.; one further spec. without abdomen).

Specimens examined :—Type, Panama : Taboga Is., ♀ (*L. E. Cheesman*) (B.M.) [recorded by Cheesman (1929) as *Polybia indeterminabilis* Sauss.]. Allotype, W. Indies : Martinique, ♂ (*Thieme*) (B.). Paratypes, Panama : Taboga Is., ix.1924, ♀ (*L. E. Cheesman*) (B.M.), 13.vi. and 9.vi.1911, 2 ♂ (*A. Busck*) (U.S.N.M.); Venta de Chiriqui, 2000–6000 ft., ♀ (*G. C. Champion*) (B.M.); Tabogal, 14.ii., ♂, 22.ii., 2 ♂, 24.ii.1912, ♂ (*A. Busck*) (U.S.N.M.); Tabogilla Is., 30.ii.1912, ♀ (*A. Busck*) (U.S.N.M.); Barro Colorado Is., 15.viii.–26.ix.1928, 2 ♀ (*P. Rau*) (U.S.N.M.); Panama, on banana, 1.viii.1935, 4 ♀ (U.S.N.M.).

If the Martinique specimen is correctly labelled, it was probably introduced into that island (perhaps with fruit). A discussion of the relation of the present species to *M. basimacula* (Cam.) is found on p. 393.

Mischocyttarus angulatus var. **columbianus** var. n.

♀. Similar to var. *angulatus* var. n. except in the following particulars :—black areas throughout more extensive; supraclypeal plate more or less outlined in black, usually with a black central line (5 spec.), sometimes entirely black (3 spec.), antennal sockets surrounded with black; ocellar area sending forward very broad black processes which are strongly (12 spec.) or moderately (1 spec.) produced into eye-emargination, process strongly emarginate antero-internally, the pair together enclosing three small spots (12 spec.) or only two anterior ones (1 spec.), lateral " wings " not distinguishable; propodeum with black antero-lateral triangles and lateral stripes broadly joined (11 spec.) or just separated (1 spec.) or widely separated (1 spec.); prepectal spot large (10 spec.), moderate (2 spec.) or absent (1 spec.), episternal spot large (12 spec.) or moderate (1 spec.), these spots more or less broadly joined (8 spec.) or more or less separated (5 spec.); metasternum entirely black; mid coxa with condyle yellow (7 spec.), fuscous (1 spec.) or black (5 spec.); hind coxa with inner side entirely (10 spec.) or with dorsal two-thirds black (2 spec.; in one spec. missing), condyle yellow (6 spec.) or black (6 spec.); abdominal tergite 5 four-fifths (1 spec.) or three-quarters (11 spec., one spec. lacks abdomen) black anteriorly, sternite 1 entirely (1 spec.), proximal three-quarters (2 spec.), two-thirds (9 spec.) or quarter (1 spec.) black; tridentate black mark on sternite 2 with arms very broadly connected anteriorly (8 spec.) or narrowly connected (4 spec.).

Length (H. + Th. + T1 + T2) 8·5–10·0 mm.; dorso-lateral margin of valve-plates of propodeum acute (4 spec.), subacute (6 spec.) or obtuse (3 spec.); length of fore-wing 9·0–11·0, average 10·0 mm.; hamuli 8–11, average 9·4.

♂. Resembles female except in the usual characters and in the following particulars :—supraclypeal plate with a dorsal black spot (4 spec.) or line (1 spec.); processes of ocellar strongly produced into eye-emargination, antero-internally strongly (2 spec.), moderately (2 spec.) or slightly (1 spec.) emarginate, enclosing three yellow spots (1 spec.) or with two

anterior spots open in front (4 spec.); antennae with segments 1–3 black dorsally, 4–5 or 4–6 brown; propodeum with antero-lateral triangles and lateral stripes widely joined; black mark on ventral half of prepectus large (4 spec.) or moderate (1 spec.), episternal mark large, these spots widely joined (1 spec.), narrowly separated (3 spec.) or widely separated (1 spec.); metasternum entirely black; mid coxa with condyle yellow (3 spec.) or fuscous (2 spec.); hind coxa with inner side entirely (4 spec.) or with dorsal two-thirds (1 spec.) black, condyle yellow (3 spec.), fuscous (1 spec.) or black (1 spec.); abdominal tergite 5 with anterior two-thirds (1 spec.) or three-quarters (4 spec.) black, sternite 1 yellow (3 spec.) or with proximal half (2 spec.) black; sternite 2 with arms of tridentate black mark separate (1 spec.), narrowly joined (1 spec.) or broadly joined (3 spec.).

Length (H. + Th. + T1 + T2) 8·0–9·0 mm.; dorso-lateral margin of valve-plate of propodeum acute (3 spec.) or subacute (2 spec.); length of fore-wing 9·0 (3 spec.) or 9·5 mm. (2 spec.); hamuli 7–9, average 8·4.

Specimens examined :—Type, COLOMBIA : Dept. Cundinamarca, La Esperanza, 1700 m., 1936, ♀ (J.B.). Allotype, COLOMBIA : Dept. Cundinamarca, Villeta, 840 m., 1936, ♂ (J.B., now in B.M.). Paratypes, COLOMBIA : Boyaca, Muzo, 900 m., 1936, 2 ♀ (J.B.), Muzo, ♀ (*Rohde*) (B.); Juntas, 2 ♀ (*Rohde*) (B.); Bogota, ♂, 2 ♀ (*Lindig*) (B.); Medellin, 5700 ft., ♂♀ (*R. A. Toro*) (U.S.N.M.), stylopised ♀ (*N. Weber*) (J.B.); no precise locality, ♂ (*Gallego*) (U.S.N.M.). " Argentinien, Cordoba," 2 ♀ (*Rohde*) (B.); " Cayenne," ♀ (D.E.I.). Bolivia : ♂ (D.E.I.).

I am strongly of the opinion that the two females labelled " Argentinien, Cordoba " are incorrectly labelled. The other specimens collected by Rohde are all Colombian; moreover there are a number of places called Cordoba (*e.g.*, in Peru, in Mexico). The record from Cayenne is also perhaps rather doubtful.

One of the females from Bogota is abnormal in having the hind margin of the furrow preceding the anterior margin of the pronotum lamellately produced; it seems nevertheless to belong to the present species, the pronotal keel being stronger and the first abdominal segment longer than in *M. basimacula* (Cam.). One female from Muzo also has this margin somewhat more acute than usual.

The stylopised female from Medellin appears to be quite unmodified apart from a little distortion of the abdomen. It bears an empty male puparium slightly on the left side beneath tergite 4.

Mischocyttarus angulatus var. **ictericus** var. n.

♀. Resembles var. *angulatus* except in the following particulars :—spot at dorsal margin of supraclypeal plate small, anterior processes of ocellar mark rather strongly produced into eye-emargination, inwardly feebly emarginate, separated by narrow yellow stripe, no lateral " wing " at level of posterior ocelli, occipital area enclosing transverse yellow spot; antennae with segments 1–8 dark brown above; posterior half of scutellum black and ferruginous, propodeum with lateral stripes hardly indicated, widely separated from antero-lateral black triangles; prepectus, meso- and metasternum not black-marked; mid coxa with dorsal stripe and condyle brown; hind coxa with posterior half of lateral stripe, dorsal stripe and moderate inner stripe brown, condyle black; marks on femora and tibiae brown; abdomen dorsally orange brown, tergites 1–3 with narrow posterior bands and (indefinitely) sides of tergites yellow, sternites entirely yellow.

Dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 10·5 mm.; hamuli 9.

♂. Differs from ♀ in usual way :—spot at dorsal margin of supraclypeal plate very small or absent, anterior processes of ocellar mark not or hardly produced into eye-emargination, inwardly more strongly emarginate, lateral " wings " present in 1 spec. (Honduras), enclosed

yellow occipital mark absent in Honduras spec.; antennae with segments 1–8 or 1–9 dark brown above; dorsal stripes of pronotum light or dark brown, scutellum posteriorly two-thirds dark but dark part mostly ferruginous in allotype, lateral stripes and antero-lateral triangles broadly connected but lateral stripes hardly indicated in Honduras spec.; mid and hind coxa with condyles both yellow (allotype) or both black; abdomen similar or with tergite 1 more black and sternite 1 proximally brown (allotype).

Dorso-lateral margin of valve-plate of propodeum obtuse (allotype) or acute; length of fore-wing 9·5, 11·0 mm.; hamuli 9, 10.

Type ♀, allotype ♂, COSTA RICA: Ocloro (*A. Alfaro*) (J.B.). Paratype, REP. HONDURAS: Tegucigalpa, 11.viii.1918, ♂ (*F. J. Dyer*) (J.B.).

I have examined a nest (Plate 1, fig. 132) of this species—PANAMA: Tabogilla Is., 30.ii.1912 (*A. Busck*) (U.S.N.M.). It is light greyish-brown, made of moderate-sized, mainly oval, flattened wood particles, varnished over and moderately shining. A few cells show bands of darker material. The petiole is 5·0 × 1·5 × 1·0 mm., heavily varnished, light silvery-grey. It is eccentric, being attached to the end cell of an outer row. It was fastened (apparently) to a small twig or root, by a plate 4·0 × 2·0 mm., with slight buttresses. There is no cone of attachment. The cells are in three rows, 4, 4, 3 = 11 cells. Apparently none are complete, the largest ones being 12·0 × 4·0 mm. The distal surface of the comb is irregular since the largest cells are in the middle of the rows.

Mischocyttarus costaricensis sp. n.

♀. Closely resembles *M. basimacula* (Cameron) except in the following particulars:—POL : OOL hardly more than 1 : 2; posterior margin of furrow preceding anterior margin of pronotum obtuse; lateral fovea moderately strong, keel as in *M. basimacula* (Cam.); valve-plate of propodeum with dorsal margin obtuse (3 spec.), subacute (4 spec.) or acute (2 spec.); length of fore-wing 9·5–10·5, average 10·1 mm.; hamuli 7–10, average 8·6; length (H. + Th. + T1 + T2) 8·0–9·0 mm.; abdominal petiole more as in *M. angulatus* sp. n. but more widened posteriorly (as in the extremer forms of *M. basimacula* (Cam.) in which the anterior part of the petiole is narrower and parallel-sided).

Supraclypeal plate with a black dorsal spot (3 spec.) or a dorsal line (1 spec.) or dorsal and ventral line (3 spec.) or black with yellow centre (2 spec.); processes of ocellar area not or slightly produced into eye-emargination, processes strongly (7 spec.) or not (2 spec.) emarginate antero-internally and sending a strong projection inwards so as together to enclose a pyriform yellow spot from the point of which a narrow black line extends to the black spot above supraclypeal plate (7 spec.) or no spot enclosed (2 spec.); antennae dorsally with segments 1–2 black and 3 brown (2 spec.) or 1–3 black (3 spec.) or 1–3 black and 4–5 brown (4 spec.); mesonotum with lateral yellow stripes (6 spec.) or not (3 spec.); anterior margin of posterior black area on scutellum straight; antero-lateral triangles and lateral stripes of propodeum widely separated; prepectus with ventral black mark in 3 spec.; mesepisternum with moderate black spot widely separated from prepectus; metasternum entirely (2 spec.) or with anterior half (4 spec.) or third to fifth (3 spec.) black; mid coxa with most of inner side black, condyle black (3 spec.), fuscous (1 spec.) or yellow (5 spec.); hind coxa with black inner dorsal line and dorsal half of inner surface also black proximally in 2 spec., condyle black (5 spec.), fuscous (1 spec.), or yellow (3 spec.); posterior margin of black on tergites 2–4 straight (7 spec.) or bisinuate (2 spec.), tergite 5 half black, sternite 1 with proximal two-thirds (6 spec.) or three-quarters (1 spec.) or whole (2 spec.) black, sternite 2 with arms of tridentate black mark narrowly connected anteriorly.

♂. Structurally resembles ♀ except in usual sexual characters. Dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 10·0 mm.; hamuli 8; length (H. + Th. + T1 + T2) 9·0 mm.

Mandibles, clypeus and supraclypeal plate entirely yellow, only a short black line between ocelli; shape of black ocellar area and its processes as in ♀ *M. basimacula* (Cam.), not as in its own female; metasternum with anterior quarter black; coxal condyles both yellow.

Specimens examined :—Type, Costa Rica : Cache, ♀ (*H. Rogers*) (B.M.). Allotype, Costa Rica : La Fuente, viii.1938, ♂ (*Alfaro*) (J.B.). Paratypes, Costa Rica : La Fuente, viii.1938, 4 ♀ (*Alfaro*) (J.B.); San Jose, xi.1911, 2 ♀ (*W. M. Wheeler*) (J.B.); Irazu,[11] 6000–7000 ft., ♀ (*H. Rogers*) (B.M.). Guatemala : Sta. Emilia Pochuta, 1000 m., ii.–iii.1931, ♀ (J.B.).

The separation of this form, whose status is still in need of exact determination, makes it possible to draw a sharper line between the principal varieties of *M. basimacula* (Cam.) and *M. angulatus* sp. n. Although the structural differences between these three forms are slight and not completely discontinuous, the differences in pattern are more definite. I give more weight to them in that they effect relatively inconspicuous elements in the pattern. It seems possible that the specimens I have placed under *M. costaricensis* are hybrids between *M. angulatus* sp. n. and *M. basimacula* (Cam.).

Mischocyttarus basimacula (Cameron).

Polybia basimacula Cameron, 1906 : 150.

♀. Colour pattern described under each variety. Pubescence as in *M. cubensis* (Sauss.) but bristles extend over ventral two-thirds of clypeus. Length (H. + Th. + T1 + T2) 7·5–9·5 mm. Structurally very similar to *M. cubensis* (Sauss.) and especially to *M. angulatus* sp. n., differing as follows :—POL : OOL nearer 1 : 2, posterior margin of furrow preceding anterior margin of pronotum acute, produced into a distinct transparent lamella overhanging the furrow, lateral fovea moderately strong, keel usually a little stronger than in *M. cubensis* (Sauss.) but weaker laterally than in *M. angulatus* sp. n. (but the latter species intergrades in this character); mesopleuron less closely punctured than in *M. cubensis* (Sauss.). Abdominal petiole hardly as long as hind femur, sides usually diverging a little even before spiracles, from them to midway to posterior margin diverging rather more strongly, from there almost parallel, posterior nearly three times as broad as anterior margin, spiracular ratio 1, spiracles not at all projecting.

♂. Clypeus with short appressed silvery pubescence; length (H. + Th. + T1 + T2) 7·0–8·0 mm. Differing from ♀ in usual sexual characters.

Mischocyttarus basimacula var. *basimacula* (Cameron, 1906).

♀. *Yellow* marked with *black*; mandibular teeth, actual ventral margin of clypeus, usually tentorial pits, black; supraclypeal plate entirely yellow (1 spec.), or with a small dorsal spot (3 spec.), or with a dorsal line (28 spec.), or with dorsal and ventral line (3 spec.) or dorsal half and sides black (1 spec.); ocellar area sending forwards large black processes which are not (29 spec.) or very slightly (7 spec.) produced into the eye-emargination, processes moderately (3 spec.), slightly (17 spec.) or not (16 spec.) emarginate anteriorly, never together enclosing a spot, at level of posterior ocelli usually with a short or very short rounded process ("wing"); sometimes absent, posteriorly with a narrow production to occiput; large occipital area (usually bearing a central yellow transverse streak), dorsal half of outer orbits narrowly and connection between inner posterior corner of eye and occipital area black; antennae more orange, segments above partly black—1–½ 3 (5 spec.), 1–3 (26 spec.), 1–3 (4 brown) (3 spec.), 1–3 (4–9 brown) (2 spec.); broad mark in front of keel and broad stripes on dorsal lobes of pronotum, mesonotum (except two rather broad discal stripes and short ones at each side opposite the tegulae) black; scutellum

[11] I believe that Irazu is in Costa Rica.

with narrow anterior and broader posterior black triangle, anterior margin of posterior black area distinctly angular (31 spec.) or rounded (4 spec.) or trapeziform (1 spec.); posterior third of postscutellum, central stripe, antero-lateral triangles (except 1 spec.), and lateral stripes (incomplete above and therefore not at all closely approaching triangles) on propodeum; mesopleuron with prepectal and dorsal furrows (more or less), prepectal spot at wing-root (usually small, rarely large or absent), no spot on ventral half of prepectus, black mark on mesepisternum large (12 spec.), moderate (13 spec.), small (9 spec.) or absent (2 spec.), the mark widely separated (25 spec.), narrowly separated (5 spec.), narrowly joined (4 spec.), widely joined (2 spec.) to prepectal suture; metasternum anteriorly with no (29 spec.) or a small (7 spec.) black mark; mid coxa with dorsal stripe and much of inner surface black, condyle yellow (12 spec.), fuscous (1 spec.) or black (23 spec.); hind coxa with three dorsal black stripes, the inner one not spreading on to inner surface, condyle yellow (11 spec.), fuscous (1 spec.) or black (24 spec.); irregular marks on mid and hind trochanters, dorsal stripe on all femora, usually minute dorsal mark on fore tibia, dorsal and posterior stripes (more or less incomplete distally) on mid and hind tibiae, abdomen with anterior two-thirds of tergite 1, about anterior half of tergites 2–4 black, posterior margin of the black nearly straight, tergite 5 less than half (4 spec.), half (28 spec.), two-thirds (3 spec.), or four-fifths black (1 spec.); sternite 1 yellow (33 spec.), with minute black central stripe (3 spec.), sternite 2 with tridentate black mark with arms widely joined anteriorly (14 spec.), narrowly joined (21 spec.), or mark absent (1 spec.); tegulae testaceous hyaline with inner margin broadly yellow; wings hyaline, more or less distinctly yellow along costa, venation yellow-brown; dorso-lateral margin of valve-plate of propodeum obtuse (16 spec.), subacute (17 spec.) or acute (3 spec.); length of fore-wing 8·5–10·5, average 9·6 mm.; hamuli 8–12, average 9·4.

♂. Mandibles and clypeus entirely yellow; supraclypeal plate with a dorsal black line (2 spec.), a dorsal spot (3 spec.) or entirely yellow (2 spec.); processes from ocellar area moderately (5 spec.) or slightly (2 spec.) emarginate antero-internally; antennal segments 1–½ 3 black (2 spec.), 1–3 (2 spec.), 1–3 black, 4–5 brown (2 spec.); anterior margin of black area on scutellum angular (6 spec.) or rounded (1 spec.); mesepisternum with a moderate (2 spec.), minute (1 spec.) or no (4 spec.) black mark; metasternum and sternite 1 yellow; mid coxa with condyle yellow (5 spec.) or black (2 spec.), hind coxa with condyle yellow (3 spec.) or black (4 spec.); sternite 2 with tridentate black mark only feebly indicated (1 spec.) or distinct and arms narrowly connected (5 spec.) or widely connected (1 spec.); dorso-lateral margin of valve-plate of propodeum obtuse (3 spec.), subacute (1 spec.), or acute (3 spec.); length of fore-wing 9·0–10·5, average 9·3 mm.; hamuli 9–12, average 9·9.

Specimens examined :—Mexico : San Luis Potosi, Tamanzunchale, ♀ no. 1364 (*P. Rau*) (J.B.); Vera Cruz, Orizaba, xii.1887, ♀ (*H. H. Smith and F. D. Godman*) (B.M.), ♀ (*Mann*) (J.B.), Huatusco, Zacuapam, 2 ♀ (*Stobbe*) (B.), Misantla, ♀ (*Gugelmann*) (B.); Tabasco, Teapa, ii., iii., and iv., 3 ♀ (*H. H. Smith*) (B.M.); Yucatan, Chichen Itza, vi.1929, ♂♀ (J.B.); state uncertain, Coatepec, ♀ (*J. Quiroz*) (B.M.), " Mex.," ♀, no data (probably Mexico), 4 ♀ (F. Smith coll.) (B.M.), Mexico, 4 ♂, 2 ♀ (*Stobbe*) (B.). British Honduras : Belize, 2 ♀ (J.B.), 2 ♀ (P. Cameron coll.) (B.M.) [both marked as *Polybia basimacula* type, one now fixed as lectotype]. Rep. Honduras : Tegucigalpa, 11.iv.1917, ♀ (*F. J. Dyer*) (J.B.); Prieta, 5.iv.1924, ♀ (J.B.), 7.iv.1924, ♀ (D.E.I.). Nicaragua : Chontales, ♀ (*Janson*) (B.M.). Costa Rica : Cache, ♀ (*H. Rogers*) (B.M.); San José, iii.1932, ♀ (*Schmidt*) (B.), ♀ (J.B.); General, ♀ (*Alfaro*) (J.B.); La Fuente, ♀ (J.B.); Aserri, ♂ (*Alfaro*) (J.B.); no locality, ♀ (J.B.). Guatemala : Quirigua, ♂ (J.B.). Panama : Bugaba, 800–1000 ft., ♀ (*G. C. Champion*) (B.M.); Lino, 800 m., ♀ (*Fassl*) (B.); Trinidad Rio, 8.v.1911, ♀ (*A. Busck*) (U.S.N.M.), no precise locality, 1926, ♀ (*G. Procter Cooper*) (J.B.).

The specimen from San Luis Potosi is unusual in having no mesosternal

spot, no black mark on sternite 2 and in having more black on anterior part of tergites 2–5.

M. basimacula (Cam.) is extremely similar to *M. angulatus* sp. n. The latter species and *M. cubensis* (Sauss.) var. *mexicanus* (Sauss.) are perhaps in reality even closer, differing essentially only in the considerably greater (though rather variable) development of the pronotal keel; but as their colour-patterns are different, as far as present material goes, they look more different. *M. basimacula* (Cam.) compared with *M. angulatus* sp. n. has a weaker pronotal keel; they intergrade in this character since specimens with the keel a little reduced occur in *M. angulatus* sp. n. The development of an acute lamina at the back of the anterior pronotal furrow and the wider first abdominal segment separate *M. basimacula* from both the other species; but these characters vary a little in their development. In colour-pattern, *M. basimacula* and *M. angulatus* are extremely similar and vary in similar directions. *M. basimacula* also resembles *M. cubensis* var. *sternalis* var. n. (p. 385). For a comparison of *M. basimacula* with *M. alfkenii* (Ducke) see p. 395.

Mischocyttarus basimacula var. **guatemalensis** var. n.

♀. Markings like var. *basimacula* except in the following particulars :—supraclypeal plate with a dorsal line (1 spec.) or with thick dorsal and thin ventral line (3 spec.), black processes from ocellar area slightly (3 spec.) or not (1 spec.) antero-internally emarginate; antennal segments 1–3 (3 spec.) black or 4–5 also brown (1 spec.); no (3 spec.) or very small (1 spec.) black spot on ventral half of prepectus; mesepisternum with a moderately large spot reaching to prepectal suture; metasternum with a minute anterior black spot; mid and hind coxa with condyles black, hind coxa with three dorsal stripes (3 spec.) or only central stripe (1 spec.); black on tergite 5 covering anterior half; sternite 1 with between anterior half and three-quarters black, sternite 2 with arms of tridentate mark widely connected anteriorly; length (H. + Th. + T1 + T2) about 9·0 mm.

Dorso-lateral margin of valve-plates of propodeum obtuse (2 spec.) or subacute (2 spec.); length of fore-wing 9·0–10·0, average 9·4; hamuli 9–10, average 9·5.

♂. Essentially similar to ♀ and like that sex with the dark markings rather more developed than in var. *basimacula* (Cam.), in particular, sternite 1 with about anterior half black; dorsal margin of valve-plates of propodeum obtuse or subacute; length of fore-wing 8·5 mm.; hamuli 9.

Specimens examined :—Type, Guatemala : Dept. Solola, Olas be Moka, ix.1908, ♀ (*G. P. Engelhart*) (J.B.). Allotype, Guatemala : San Sebastian, Helvetia, 1000 m., 21–22.iv.1931, ♂ (J.B.). Paratypes, Guatemala : no further data, ♀ (D.E.I.), Guatalon, Moca, 1000 m., iii.–iv.1931, ♀ (J.B.). Rep. Honduras : Tela, 26.i.1931, ♀ (J.B.). Costa Rica : Aserri, ♂ (*Alfaro*) (J.B.).

This variety differs chiefly from var. *basimacula* in having sternite 1 mainly black; the other dark marks are also better developed.

Mischocyttarus basimacula var. **superpictus** var. n.

♀. Markings as in var. *basimacula*, except in the following particulars :—supraclypeal plate black, except for a small central spot (6 spec.) or yellow with dorsal and ventral black lines (1 spec.); black marks of vertex larger, a little produced into eye-emargination, moderately emarginate antero-internally, enclosing (except 1 spec.) a large yellow spot which bears a central black line; all black markings of thorax and propodeum broader (antero-lateral triangles and lateral stripes of propodeum still widely separated); lateral stripes of mesonotum present (6 spec.) or absent (1 spec.); ventral half of prepectus black and this mark widely joined to much larger mesepisternal black spot; postero-ventral

corner of lower half of metapleuron black; coxal condyles yellow (4 spec.) or black (3 spec.); proximal half or two-thirds of abdominal sternite 1 black; tridentate mark on sternite 2 with arms very broadly connected anteriorly. Length (H. + Th. + T1 + T2) 8·0 mm.

Structurally similar to var. *basimacula*; dorso-lateral margin of valve-plate of propodeum obtuse (5 spec.), or acute (2 spec.); length of fore-wing 9·0–11·0, average 9·7 mm.; hamuli 7–10, average 8·6.

♂. Essentially similar to ♀, but black markings less developed; supraclypeal plate yellow; arms of black ocellar area not enclosing a spot; mesonotum with yellow lateral stripes; prepectus without black ventral mark; mesepisternum with rather large mark narrowly joined to prepectal suture; metasternum yellow; sternite 1 with anterior two-thirds black; mid coxa with condyle fuscous, hind one black; dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 8·5 mm.; hamuli 9.

Specimens examined :—Colombia : Cauca, Rio Porce, nr. Porcecito, ♀ type, ♂ allotype (*N. A. Weber*) (J.B.). Paratypes, Colombia : same data as type, 5 ♀; Dept. Boyaca, Muzo, 900 m., 1936, ♀ (J.B.).

Type and allotype in Dr. J. Bequaert's collection; some paratypes in B.M.

Mischocyttarus basimacula var. *flavicornis* Zikán.

Mischocyttarus flavicornis Zikán, 1935 : 168.

♀. Markings as in var. *basimacula*, except in the following particulars :—top of supraclypeal plate with a black spot (21 spec.) or small transverse line (30 spec.); black processes from ocellar area not emarginate on inner side before antennae (45 spec.) or slightly so (6 spec.), yellow transverse streak on black occipital area present or absent; only antennal segments 1–2 black above (50 spec.) or 1–¼ 3 (1 spec.); mark in front of pronotal keel smaller; ventral half of prepectus yellow, no spot on mesepisternum (30 spec.) or a small brown one (21 spec.), metasternum yellow; mid coxa with inner dorsal and inner surface fuscous, condyle black (30 spec.), fuscous (1 spec.) or yellow (20 spec.); hind coxa with fuscous dorsal stripes, outer one absent or very short (only developed posteriorly), inner one very narrow or widely interrupted in centre, condyle black (31 spec.), fuscous (1 spec.) or yellow (19 spec.); marks on legs fuscous or pale brown; dark marks on abdomen reddish-brown, those on tergites 2–5 covering anterior two-thirds, no black markings on sternites 1–2; wings more strongly yellow-suffused, length (H. + Th. + T1 + T2) 9·0–10·0 mm.

Structurally similar to var. *basimacula*; dorso-lateral margin of valve-plate of propodeum obtuse (40 spec.) or subacute (11 spec.); length of fore-wing 9·0–12·0, average 11·2 mm.; hamuli 8–11, average 9·1.

♂. Closely similar to ♀, apart from normal sexual differences; dorso-lateral margin of valve-plate of propodeum obtuse (9 spec.), subacute (2 spec.) or acute (1 spec.); length of fore-wing 9·5–12·0, average 10·3 mm.; hamuli 8–9, average 8·7.

Specimens examined :—Peru : Col. Perene, El Campamiento, 21.vi.1920, 1 ♀ (*Cornell Univ. Exped.*) (J.B. now B.M.), 12 ♀ (C.), 25.vi.1920, 3 ♀ (C.), Hacienda da San Juan, 24.vi.1920, ♀ (C.), Hazienda no. 2, 26.vi.1920, 4 ♂, 13 ♀ (C.); San Ramon, 12.vii.1920, 7 ♂, 9 ♀ (*J. H. Williamson*) (C.); R. Pichis, Puerto Bermudez, 12–19.vii.1920, 3 ♀ (C.); R. Tarma, Huacapistana, 16.vi.1920, 3 ♀ (C.); Puerto Yesup, 212 m., 11.vii.1920, 1 ♀ (C.); Chanchomayo, 9.vii.1937, 1 ♀ (*J. E. Wilk*, 140–37) (J.B.), Valle Chanchomayo, 1.iv.1939, ♂, 3 ♀ (*Weyrauch*, 11, 12, 34) (J.B.). Brazil : Chapada, ♀ (J.B.).

Dr. Bequaert identified two specimens, I think correctly, with *M. flavicornis* Zikán, 1935, described from Brazil, Goyaz. It is possible that in the Goyaz specimens the dark parts of the abdomen are black, not brown.

Rau (1933 : 135, figs. 63, c and d) has published photographs of two nests *M. basimacula* (Cam.) from Panama. One had seventy cells, the other

forty-two; in both the petiole was central. Three nests were infested with the Phorid fly *Megaselia* (= *Aphiochaeta*) *scalaris* (Lw.). Bequaert (1937) records three adult wasps captured in a grocery store in Iowa, where they had emerged from a nest in a bunch of bananas.

I have examined four nests (pl. 1, figs. 127–9), all rather small. No. 393, Mexico: Orizaba, xii.1887 (*H. H. Smith and F. D. Godman*) (B.M.). No. 394, Panama: Bugaba, 800–1000 ft. (*Champion*) (B.M.). No. 395, Panama: Trinidad Rio, 8.v.1911 (*A. Busck*) (U.S.N.M.). No. 396, Mexico: Misantla (*Gugelmann*) (B.). No. 393 bears the note "under projecting part of stone wall. Several wasps on nest." It is light brown, moderately well-varnished, made of flat wood-particles, mostly small and oval. There are some "windows" closed with varnish only. The petiole is 4·0 × 1·5 × 1·0 mm., the attachment plate 3·0 × 2·5 mm. and there are almost no buttresses between it and the petiole. There is a large cone of attachment. The petiole is eccentric, attached to the penultimate cell of the centre row and flattened parallel to the rows. There are five rows of 3, 4, 4, 4, 3 = 18 cells. One outer row and the ends of rows near the petiole consist of very small cells. No cells seem to be quite complete but the last two farthest from petiole in each row are larger than the others. The comb is little oblique to the petiole. The eggs are attached about 2·0 mm. from the bottoms of the cells. No. 394 is very similar, consisting of 4, 4, 5, 5, 3 = 21 cells. The cells are all short, 4·0–5·0 mm. long, and the petiole is attached to the end cell of the second row of four. No. 395 is made of more variegated carton, grey and reddish-brown with a rather heavy varnish. There are two rows of 3, 4 = 7 cells and the petiole is attached to the end cell of the row with 4. No. 396 is a small nest of 3 cells with a 3·0-mm. long petiole which had apparently been attached to mossy earth.

Mischocyttarus alfkenii (Ducke).

Megacanthopus alfkenii Ducke, 1904 : 362.

This species is exceedingly closely allied to *M. basimacula* (Cameron). Apart from colour, it can only be separated from that species by the somewhat longer and narrower abdominal petiole. As this varies in both species and their characters nearly if not quite overlap, their separation without reference to colour is a difficult matter. *M. basimacula* (Cam.) is more northern and western in distribution, is a more lemon-yellow, with nearly always sharply defined black markings. *M. alfkenii* (Ducke) is more southern and eastern, the yellow is more orange, and the black is usually edged or even replaced by brown. No two varieties of the species have a quite identical pattern, which will be described separately for each variety.

♀. Eyes in contact with clypeus for a considerable space; POL : OOL = 1 : 2; anterior margin of furrow preceding anterior margin of pronotum acute, usually distinctly lamellate, keel about straight (sometimes a little convex or concave anteriorly), moderately strong and ending abruptly at sides, weak or obsolete in centre, about as in *M. basimacula* (Cam.), clearly stronger at sides than in *M. cubensis* (Sauss.), weaker in centre than in *M. angulatus* sp. n., fovea rather small; abdominal petiole usually somewhat longer and narrower than in *M. basimacula* (Cam.) but with the anterior part shorter and less parallel-sided than in *M. angulatus* sp. n. or in *M. cubensis* (Sauss.); length (H. + Th. + T1 + T2) 8·5–11·5 mm.

♂. Differs from ♀ in usual sexual characters of this group; differs from allied species in the same way as ♀.

Mischocyttarus alfkenii var. *alfkenii* (Ducke).

Megacanthopus alfkenii Ducke, 1904 : 362.

♀. Yellow with black markings which are partly bordered or replaced by brown; no

supraclypeal spot; antennae entirely orange; black ocellar marks extending nearly to antennal sockets but becoming brown in front, at level of posterior ocelli with distinct lateral " wings," occiput with a linear black mark broadly connected to ocellar mark and to outer orbits; pronotum with a brown mark in front of keel, dorsal lobes with brown marks; mesonotum black with four yellow stripes, central pair separated by less than their width; scutellum with narrow, triangular marks in front and behind connected by a central line; postscutellum with a posterior triangular mark; propodeum with moderately broad, central, black stripe, with antero-lateral triangles separated from stripe by half its width or less, and more or less complete lateral stripes; even sutures of meso- and metapleuron only very narrowly black, spot beneath root of fore-wing small or absent, meso- and metasternum without black spots; mid coxa and its condyle yellow, femur indistinctly brown-striped; hind coxa with more or less distinct, central, brown stripe, condyle yellow or fuscous, femur indistinctly brown-striped; abdomen uniform reddish-brown or reddish-brown with tergite 1 anteriorly and posteriorly and tergites 2–5 narrowly posteriorly yellow, sternites yellow-brown or yellow; tegulae yellow; wings very feebly infuscate, costal cell a little yellow-tinged, venation yellow-brown; length of fore-wing 11·0–11·5 mm.; dorso-lateral margin of valve-plate of propodeum obtuse; hamuli 8–9.

♂. Similar; occipital line divided into three spots, not connected to orbits (in one specimen); lateral stripes of propodeum represented only by ventral spots; length fore-wing 10·0–10·5 mm.; dorso-lateral margin of valve-plate of propodeum subacute; hamuli 9.

Specimens examined :—N.W. Brazil : Teffé, 28.ix.1904, ♀ (*Ducke*) (B.M.); R. Japurá, 17.ix.1904, ♀, 21.ix.1904, 2 ♂ (*Ducke*) (B. and B.M.) (all det. as *M. alfkenii* by Ducke).

M. alfkenii was described by Ducke from Brazilian Guiana (Mazagão, Oyapoc and Obidos) and the only specimens which I have seen from this region are different in colour-pattern from those found elsewhere. The type is presumably in the Museu Goeldi, Pará.

Mischocyttarus alfkenii var. **excrucians** var. n.

♀. Yellow with rather extensive black marks; a minute supraclypeal black or brown mark; antennae orange with segments 1 or 1–2 more or less black above; black ocellar mark extending to antennal socket, hardly becoming brown anteriorly, lateral " wings " rather strong, occiput broadly black with a small, transverse, yellow mark enclosed; pronotum with large, transverse, black or brown mark in front of keel, dorsal lobes with broad, black or brown marks; mesonotum black with four yellow stripes, central pair separated by twice their width; scutellum with anterior and posterior black triangles whose apices meet or nearly; postscutellum with a triangular black mark covering posterior half; propodeum with moderately broad, central black stripe, with antero-lateral triangles (black or brown) separated from stripe by half its width, and (in Colombian spec.) nearly complete lateral stripes; sutures of meso- and metapleuron rather broadly black, ventral half of prepectus yellow, black spot beneath root of fore-wing large, mesosternum (in Colombian spec.) with a small, lateral, black spot, metasternum yellow; mid coxa yellow with inner surface brown or pale brown, condyle black (Colombian spec.) or yellow, femur with postero-dorsal brown stripe; hind coxa with three dorsal stripes, lateral one incomplete anteriorly, condyle black (2 spec.) or yellow (1 spec.), femur brown with antero-dorsal yellow stripe; abdomen red-brown, tergites posteriorly indistinctly yellow, sternites 3–6 more yellow; tegulae yellow with large testaceous outer spot; wings feebly infuscate, costal cell somewhat yellower, venation yellow-brown; dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 10·5, 11·0, 12·0 mm.; hamuli 9, 10, 10.

♂. Resembles ♀ except for usual sexual differences; black ocellar mark with no lateral wings; propodeum and abdominal petiole heavily black-marked; dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 11·0 mm.; hamuli 9.

Type, COLOMBIA : Dept. Meta, Restrepo, 500 m., 1936, ♀ (J.B.). Allotype, SURINAM : R. Surinam, Sint Barbara Plantation, 15.iv.1927, ♂ (C.). Paratypes : ♀ same data as allotype; ♀, no data (? Surinam) (C.).

This is like a darker form of variety *alfkenii*, but the darkening of the first two antennal segments is a character of some importance in this group. It is possible that it is a hybrid between var. *alfkenii* (Ducke) and var. *trinitatis* var. n.

Mischocyttarus alfkenii var. **trinitatis** var. n.

♀. Yellow, black markings sometimes largely replaced by brown; no supraclypeal spot; antennal segments 1–2 more or less black above, 3–12 brown to nearly black (except in three specimens—Colombia, Venezuela—where 3–12 are orange); black ocellar mark extending half (14 spec.) or two-thirds or more (13 spec.) or even the whole of way (3 spec.) to antennal sockets, often becoming brown anteriorly, lateral wings moderate (4 spec.), short (15 spec.) or absent (11 spec.), occiput with linear black mark which is interrupted into three spots in 7 spec.; pronotum with a more or less indistinct brown mark in front of keel, dorsal lobes with dark brown or black (9 spec.), brown (10 spec.) or pale brown or no (5 spec.) marks; mesonotum black with four yellow stripes, central pair separated by from rather more to only one-third their width, by considerably less than width in 7 out of 30 spec.; scutellum usually with more or less distinct anterior, posterior and central black lines, anterior line becoming triangular in one specimen only; postscutellum yellow, even posterior line nearly always very indistinct; propodeum with central stripe narrow but continuous (12 spec.) or represented only by ventral spot (16 spec.), or absent (2 spec.), lateral triangles absent or (5 spec.) very faintly represented in brown or black (1 spec.), lateral stripes represented by a ventral spot (18 spec.) or extending half-way (12 spec.); even sutures of meso- and metapleuron only very narrowly black, spot beneath root of fore-wing very small or absent (14 spec.), meso- and metasternum without black spots; mid coxa yellow or (11 spec.) inner surface partly brown, condyle yellow, fuscous (1 spec.) or black (2 spec.), femur with indistinct, dorsal, brown stripe; hind coxa yellow (6 spec.), or with lateral brown stripe more or less incomplete anteriorly (5 spec.) or with lateral and central stripes (19 spec.), condyle yellow (19 spec.) or fuscous to black (11 spec.), femur with more or less distinct postero-dorsal brown stripe; tergite 1 yellow with central half brown or black, tergites 2–5 with anterior two-thirds to three-quarters black or brown, always with a sharp contrast between anterior dark area (with curved posterior boundary) and posterior yellow band, sternites yellow; tegulae yellow with small, central testaceous spot; wings hyaline (rarely somewhat browner), costal cell yellower, venation yellow-brown; dorso-lateral margin of valve-plate of propodeum obtuse (10 spec.), subacute (16 spec.) or acute (4 spec.); length of fore-wing 9·0–11·5, average 10·1 mm.; hamuli 8–12, average 9·6.

♂. Very similar to ♀; dorso-lateral margin of valve-plate of propodeum obtuse, subacute or obtuse; length of fore-wing 9·5, 9·5, 10·0; hamuli 7, 9, 11.

Specimens examined :—Type, B.W.I., TRINIDAD : Quare R. valley, 25.i.1931, ♀ (*A. K. Totton*) (B.M.). Allotype, B.W.I., TRINIDAD : Port of Spain, St. Ann's, v.1938, ♂ (*P. L. Guppy*) (Oxford Univ. Mus.). Paratypes, B.W.I., Trinidad : same data as type, ♀; same nest as allotype, 5 ♀; Trinidad, 4 ♀ (*G. I. Clarke*) (B.M.), ♀ (J.B.), ♀ (*Hilgendorf* (B.), 16.iv., 2 ♀, 30.iv., ♀, 20.v.1925, ♀ (*H. M. Rohwer*), ♀ (*A. Busck*) (U.S.N.M.); Port of Spain, 2 ♀, 2 ♂ (*H. Caracciola*) (U.S.N.M.), 5.vi.1924, 2 ♀ (*H. M. Rohwer*) (U.S.N.M.). Colombia : ♀ (*Moritz*) (B.); Buenaventura, 16.xii.1938, ♀ (*Weyrauch*) (J.B.); Puerto Colombia, ♀ (*C. Morley*) (B.M.). VENEZUELA : Caracas, ♀ (*Gollmer*) (B.), Pto. La Cruz, xii.1924, ♀ (*H. Pittier*) (U.S.N.M.); near Isla Paloma, R. Orinoco, i.–ii.1935, ♀ (*N. A. Weber*) (J.B.). BRITISH GUIANA : Mazaruni Station, clearing, 17.ix.1937, ♀ (*Richards and Smart*) (B.M.); Demerara R., Green nick park, 28.xii.1911, ♀ (*G. E. Bodkin*) (B.G. Dept. Agric.).

This is the form of *M. alfkenii* which runs closest to *M. basimacula* (Cam.); the structure of tergite 1 overlaps, though it is broader on the average in *M. basimacula*. The variety does not have the sulphur-yellow background with sharply defined black markings of *M. basimacula*, while sternite 2 is never black-marked.

Mischocyttarus alfkenii var. **bahiae** var. n.

♀. Yellow, head and thorax black-marked, abdomen red-brown or with posterior segments black, but not banded; no, or (1 spec.) a very minute, black supraclypeal spot; antennae black dorsally, except sometimes last one or two segments; black ocellar mark usually extending to antennal sockets, black throughout (7 specimens) or considerably paler anteriorly (8 spec.), in one specimen hardly produced in front of ocelli, lateral wings moderate (4 spec.), short (10 spec.) or absent (2 spec.), occiput usually with narrow, linear, black mark (8 spec.) or with three separate black spots (6 spec.), rarely unmarked (1 spec.) or broadly black enclosing a transverse yellow spot (1 spec.); pronotum with a more or less indistinct brown mark in front of keel, dorsal lobes with pale or dark brown marks; mesonotum black with four yellow stripes, central pair usually separated by their width or rather less (11 spec.), rarely by rather more (2 spec.) or by half their width or less (3 spec.); scutellum with narrow anterior border and central line black, rarely black somewhat increased or reduced; postscutellum with very narrow or indistinct, posterior, black line; propodeum with continuous, often brown, central line (4 spec.), or line more or less interrupted (10 spec.), or only a ventral spot (2 spec.), lateral triangles represented in brown in 3 spec. only, lateral stripes only appearing as ventral black spot; sutures of meso- and metapleuron at most very narrowly black, spot beneath root of fore-wing very small or absent (1 spec.); meso- and metasternum yellow; mid coxa and its condyle yellow, femur with dorsal brown stripe, often rather indistinct; hind coxa yellow (4 spec.), or with mid dorsal stripe (4 spec.), or with mid dorsal and more or less incomplete latero-dorsal stripe (6 spec.), or with traces of inner stripe in addition (2 spec.), condyle yellow (6 spec.), fuscous (1 spec.) or black (9 spec.), femur with a more or less distinct dorsal brown stripe, last two or three specimens of tarsi darkened in darker specimens; tergite 1 yellow or with central two-thirds more or less brown (in 1 spec. dark), tergites 2–6 yellow-brown, without or with very indistinct posterior yellow margins (3 spec.), or tergite more or less dark brown and tergites 3–6 black (13 spec.), sternites 1–2 always yellowish, 3–6 yellow-brown in pale specimens, 3–6 blackish (12 spec.), or 3 yellow, 4–6 blackish (1 spec.) in dark form; tegulae yellow with more or less large, outer testaceous area; wings a little infuscate, costal cell yellower, venation yellow-brown; dorso-lateral margin of valve-plate of propodeum obtuse (2 spec.), subacute (10 spec.) or acute (4 spec.); length of fore-wing 9·0–11·0, average 10·1 mm.; hamuli 7–11, average 8·9.

♂. Resembles ♀ except for normal sexual differences (3 of form with pale abdomen); occiput with a transverse line (1 spec.), or with three separate black spots (2 spec.); dorso-lateral margin of valve-plate of propodeum obtuse (1 spec.) or acute (2 spec.); length of fore-wing 9·5, 10·5, 10·5 mm.; hamuli 9, 9, 10.

Specimens examined :—Type, Brazil : ♀ [12] (F. Smith coll.) (B.M.). Allotype, Brazil : Bahia, ♂* (*Gomez*) (B.). Paratypes, Brazil : Pernambuco, 2 ♀ (B.M.); Bahia, 20.ix.1923, ♂ (*G. L. R. Hancock*) (O.W.R.), ♀ stylopised, ♀* (*Gomez*) (B.); no precise locality, ♀* (F. Smith coll.) (B.M.); Rio de Janeiro, 27.vi.1918, ♂ (*R. Fischer*) (D.E.I.). Paraguay : San Bernardino, 7 ♀ (*K. Fiebrig*) (B.); Asunçion, Villa Morra, 30.xi.1904, ♀ (*J. D. Anisits*) (B.); Pirada á Salto, Ỹguaru, 15–16.i.1904, ♀ (*J. D. Anisits*) (B.); Paso Yobay, ♀ (*F. Schade*) (J.B.).

[12] Specimens with yellow-brown abdomen are marked with an asterisk.

The stylopised specimen has a female puparium on the left side of tergite 5; the host appears to be unaffected except for a little distortion of the abdomen.

This variety appears to be quite close to the var. *trinitatis* var. n. and less allied to the nominotypical form. The two types of abdomen colour might be considered as distinct varieties, but in this group banding or non-banding seem to be more important characters than the actual colour of the abdomen. The yellow-brown forms are confined to the north in the material studied.

Mischocyttarus alfkenii var. **zikanii** var. n.

Megacanthopus bistriatus of some authors, *not Polistes bistriatus* Fabricius, [1805] : 281.

♀. Yellow, black markings often considerably replaced by brown, especially on banded abdomen; supraclypeal spot absent (7 spec.), minute (2 spec.) or represented by a line (3 spec.); antennal segments more or less black dorsally or (1 spec.) 3–12 only dark; black ocellar mark extending to antennal sockets, anterior half sometimes paler (6 spec.), lateral wings absent (4 spec.), small (7 spec.), or large (1 spec.), occiput with moderately broad black line (8 spec.) or line divided into three spots (4 spec.); pronotum with spot in front of keel brown (7 spec.) or black (5 spec., in two extending across whole width), dorsal lobes with brown (8 spec.) or black (4 spec.) marks; mesonotum black with four yellow stripes, central pair about as broad as distance between them (7 spec.) or considerably broader (3 spec.), rarely half as broad (2 spec.); scutellum with narrow anterior, posterior and central lines (7 spec.) or with narrow triangular anterior and linear posterior areas and a small triangular area on disc just separate from posterior area (5 spec.); postscutellum with rather distinct posterior black line; propodeum with central stripe narrow but continuous (brown in 2 spec.), lateral triangles represented in black (1 spec.), in pale brown (only 2 spec.), lateral stripes represented by ventral spot (10 spec.) or nearly complete (2 spec.); meso- and metapleural sutures only narrowly black (broadly 1 spec.), spot beneath root of fore-wing small, ventral half of prepectus yellow (black in 1 spec.), mesosternum with lateral black spot (3 spec.), metasternum with small anterior spot (same 3 spec.); mid coxae yellow (5 spec.), or with inner dorsal dark stripe (3 spec.) or inner side brown (4 spec.), condyle yellow (10 spec.) or black (2 spec.); femur with more or less distinct dorsal brown stripe; hind coxae with mid dorsal stripe brown (8 spec.), or with lateral, mid and inner dorsal stripes (4 spec.), condyle yellow (7 spec.) or black (5 spec.), femur with dorsal dark stripe, last two or three tarsal segments usually darkened; tergite 1 yellow with central two-thirds brown (3 spec.) or brown to black with only distal quarter yellow (9 spec.), tergites 2–6 yellow, about the anterior three-quarters black or dark brown, posterior margin of dark area usually nearly straight, sternites 1–6 yellow (9 spec.) or 5–6 black (2 spec.) or 2–6 black-marked (1 spec.); tegulae yellow with large outer testaceous spot; wings hyaline or a little infuscate, costal cell yellower, venation yellow-brown; dorso-lateral margin of valve-plate of propodeum obtuse (3 spec.), subacute (6 spec.) or acute (3 spec.); length of fore-wing 10·0–11·5, average 10·5 mm.; hamuli 8–12, average 9·6.

♂ (only one very dark spec. available). Resembles ♀; ocellar marks of each side fused, so that greater part of vertex above antennae (except orbits) is black, occiput broadly black, enclosing yellow, transverse spot; propodeum with central stripe, brown lateral triangles and nearly complete lateral stripe; ventral half of prepectus black, mesosternum with large spot only just separate from prepectal one, metasternum largely black; tergites 1–5 black with distal quarter yellow, 6–7 yellow, sternites 1–6 yellow, 7 mainly blackish; dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 9·5 mm.; hamuli 8.

Specimens examined :—Type and allotype, PARAGUAY: Alto Parana, Puerto Bertoni, iii.1908, ♀♂ (*A. de W. Bertoni*) (B.M.). Paratypes, Paraguay : same data as type, 2 ♀ (B.), same place, no date, ♀ (J.B.); Asunçion, 22.ii.1905, ♀ (*J. D. Anisits*) (B.), Villa Morra, 18.xii.1905, ♀ (*J. D. Anisits*) (B.); San

Bernardino, 5 ♀ (probably *ex* alcohol, very discoloured) (B.); Paso Yobay, ♀ (*F. Schade*) (J.B.).

This variety is easily separated from *M. paraguayensis* Zikán in the male by the shorter thirteenth antennal segment, but I can find no reliable character to distinguish the females. Compared with that species the sculpture of the mesopleuron and propodeum is somewhat sparser and less granulate and the pronotal keel is less widely interrupted, while the abdominal petiole is somewhat longer and narrower. In *M. paraguayensis* the dark marks of tergites 1–2 are brown, contrasting with the black marks of tergites 3–5. In var. *zikanii*, this contrast is lacking.

In describing this species from N.W. Brazil, Ducke (1904 : 362) mentions that the nest is like that of *M. surinamensis* (Sauss.) but a little larger. In (1905 : 688, pl. 4, fig. 24, a and b) he figures two nests. In one, a front view of a large circular comb of 150–200 cells is shown. There are a few cocoons in the centre and in a narrow intermediate ring. The other nest is a small one of 16–20 cells in about three rows. The petiole is very eccentric. In (1907 : 188) he notes that the species is commonly found round houses and that the petiole is usually subcentral. Bertoni (1911 : 127) (as *Megacanthopus indeterminabilis*) in Paraguay states that the wasp is extraordinarily variable in colour and in nest structure. The extreme forms of nest are very distinct but in a large number all gradations are found. The common type of nest resembles that of *Polistes versicolor* (Oliv.), the comb broadening gradually, so that one was 26 cm. long and 2·0 cm. broad. At the other extreme, two nests attached to a roof were rounded with a lateral petiole. The normal pattern of the wasp in Paraguay resembles that of *Polybia fastidiosuscula* Sauss. and its varieties. The patterns may occur in any type of nest, but the pattern is constant in any one nest. Poulton (1933) (as *Polybia fasciata*) describes the habits of var. *trinidadensis*. In Trinidad, also, it tends to build near houses and one is described which was attached to an electric light-bulb.

I have examined two small nests (pl. 1, figs. 130–1), no. 399, Venezuela : Caracas, La Cruz, xii.1924 (*H. Pittier*) (U.S.N.M.) (var. *trinitatis*); no. 400, Colombia : Dept. Meta, Restrepo, 500 m. (J.B.) (var. *excrucians*). No. 399 is light yellowish-grey composed of moderate-sized, mainly oval wood-particles, light varnished. The petiole is broken but was evidently considerably flattened and heavily varnished and attached by a small cone to the end cell of the middle row. There are three rows of 2, 3, 3 = 8 cells, all unfinished. No. 400 is light grey-brown, made of rather irregular, relatively large flat wood-particles, well varnished. The petiole is broken but eccentric, being attached to the end cell of the middle row. There are 2, 3, 2 = 7 cells all incomplete. Four still have shrivelled eggs attached 2·0–3·0 mm. from the bottom.

Mischocyttarus phthisicus (Fab.).

Vespa phthisica Fabricius, 1793 : 281.
Mischocyttarus phthisicus Ducke, 1914 : 328.
Polybia indeterminabilis de Saussure, [1854] : 201, but *not* of most authors.

♀. Head *ferruginous*; tips of mandibular teeth and actual ventral margin of clypeus *black*; mandibles, malar space, inner and outer orbits (more or less broadly) *yellow*. Thorax and propodeum *black*, pro- and mesonotum more or less *ferruginous* (specimens with more ventral parts more or less ferruginous are perhaps immature); ventral angle, keel, and posterior margin of pronotum, sometimes two discal lines on mesonotum, about anterior half of scutellum and postscutellum, and their lateral lobes, propodeum with two large, suboval spots (more or less pointed above) extending along three-quarters of sides of furrow

from below, orifice and valve-plates, spot at top of prepectus, more or less distinct spots at ventral furrow and at postero-ventral corner of mesopleuron, most of dorsal half of metapleuron, *yellow*. Legs *black* with tibiae and tarsi, some marks beneath fore coxae, distal quarter (more ventrally) of fore femora, more or less distinct ventral mark on mid coxae, one or two dorsal marks on hind coxae, distal marks on mid and hind femora *yellow*. Abdomen with segment 1 black but its distal quarter yellow; rest of abdomen ferruginous, tergites 2–3 with narrow, posterior yellow bands; sternites 2–3 sometimes with traces of such bands laterally. Tegulae almost entirely yellow. Wings somewhat yellow-tinged, especially along costa, venation pale yellow-brown. Pubescence as in *M. cubensis* (Sauss.). Length (H. + Th. + T1 + T2) 7·5–9·5 mm.

Structurally only differing from *M. cubensis* (Sauss.) as follows:—pronotum with posterior margin of furrow preceding anterior margin varying from a right-angle (hardly acute) to acute and overhanging the furrow (margin produced into an indistinct, transparent lamella, less well developed than in *M. alfkenii* (Ducke), etc.), fovea rather to distinctly small; propodeal furrow a little narrower and better defined, dorso-lateral margin of valve-plate obtuse (4 spec.), subacute (3 spec.) or acute (7 spec.) (1 not recorded); hind tarsi with the claws little asymmetrical, the larger one sharp; length of fore-wing 8·5–10·0, average 9·4 mm.; hamuli 8–11, average 9·5.

♂. Similar to ♀ in colour, but ventral margin of clypeus not black; coxae black; large antero-discal area on mesosternum yellow; clypeus with short silvery pubescence. Length (H. + Th. + T1 + T2) 9·0 mm.

Structurally differs from ♀ in usual way; dorso-lateral margin of valve-plates of propodeum acute; length of fore-wing 9·0 mm.; hamuli 9.

Specimens examined:—Haiti: ♀ (B.M.), ♀ (*Kesthal*) (B.), San Domingo, ♀ (B.M.). Porto Rico: Corozoal, 2.vii.1915, ♀ (D.E.I.), 1925–26, 3 ♀ (*H. E. Box*) (B.M.), ♀ (*Krug.*) (B.), Ponce, 6.iv.1930, ♂ (J.B.). Virgin Is.: 13.viii., 2 ♀ (*Curator*) (B.M.). St. Lucia: 1851, ♀ (*Bonnecour*) (Paris) [type of *Polybia indeterminabilis* Sauss.]. Colombia: 2 ♀ (*Moritz*) (B.). "S. America": ♀ (B.). "N. Granada": ♀ (B.).

I follow Bequaert (1933) in his interpretation of this species, not having seen the type. *Polybia indeterminabilis* Saussure is certainly the same, but no other specimen of the species is known from St. Lucia. Possibly members of this group of *Mischocyttarus* are especially liable to be carried about by commerce.

Subgenus *Omega* Saussure [1854] (text-figs. 70–73).

Type (monobasic) = *Polybia filiformis* Saussure [1854].

The characters of the adults are given in the key, p. 308, but no males have been available for study. The variation in the number of spurs on the mid tibia is known in some Zethinae, as well as in *M. pallidipectus* (Smith) ♂.

Larva. Unknown.

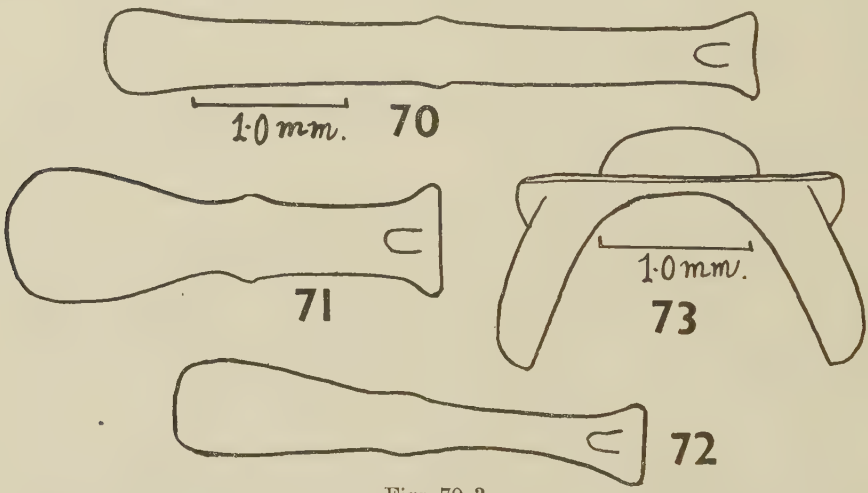
Nest. This has been described in three species of the group, but it seems impossible to find anything in common between them. The nest of *M. cristatus* Zikán has been described and figured by Zikán (1935 : 201–2, pl. 2, fig. 5). The nest was found near Rio de Janeiro attached to the inverted upperside of an orange-leaf, 3 m. from the ground. It resembles the nest of *M. injucundus* (Sauss.) but is lighter coloured (light reddish-brown) and the petiole is thin, round, 7·0 mm. long and almost concentric. The 26 cells form five rows and the comb is somewhat convex. When found, there were 9 ♂, 10 ♀ on the nest and it contained 8 cocoons.

Mischocyttarus cristatus Zikán, 1935 : 201, which I have not examined, appears to belong to this group and has been included in the key (p. 318).

Mischocyttarus filiformis (Sauss.).

Polybia (*Omega*) *filiformis* Saussure, [1854] : 206.

♀. Black; mandibles, narrow posterior orbital margin, clypeus (except narrow central stripe on dorsal two-thirds), inner orbital margin rather broadly to dorsal limit of eye-emargination, antennal segment 1 beneath (antennae 10–12 a little rufous beneath), a transverse comma-shaped spot above each antennal socket (spots not quite meeting), broad posterior margin and band across transverse keel of pronotum, two small lines on disc of mesonotum, scutellum (except axillae and small posterior strip), a transverse, anterior line on each side of postscutellum, a large circular ventral spot on propodeum on each side and all keels surrounding the orifice, a spot on mesopleuron just below anterior spiracle and another just above mid coxa, posterior margin of mesosternum, narrow posterior and postero-lateral band on tergite 1, narrow posterior bands on tergites 2–5, narrow posterior band on sternite 2, most of sternites 2–6, *yellow*. Legs black with the following *yellow* marks:



Figs. 70–3.

Fig. 70. Dorsal view of abdominal tergite 1, *M. filiformis* (Sauss.) type ♀.
71. The same, *M. buyssoni* (Ducke) ♀.
72. The same, *M. punctatus* (Ducke) ♀.
73. Dorsal view of pronotum, *M. punctatus* (Ducke) ♀.

a ventral distal spot on fore coxae, streak on distal half of fore femora ventrally, fore tibiae and tarsi (except anterior brown streak on former), mid coxae almost entirely beneath, mid femora narrowly distally, mid tibiae, except broad black anterior and posterior streaks on central half, mid basitarsus (except distal fifth), two dorsal streaks on the hind coxae, small distal spot on hind femur. Tegulae testaceous. Wings a little infuscate. Surface of head and thorax with moderately dense outstanding pale pubescence (more recumbent on face). Legs and abdomen with very short pale pubescence; abdominal sternites, especially 6, with dense outstanding pale pubescence. Length (H. + Th. + T1 + T2) 10·0 mm.

Head dull, very finely sculptured, with sparse punctures on the vertex. Mandibles moderately shining with rather numerous large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest almost obliterated. Width of clypeus where eyes approach most closely a little greater than half its length, ventral margin weakly subangularly produced, not impressed or differently sculptured. Tentorial pits more than twice as far from antennal sockets as from eyes. Antennal segment 3 as long as 1. Antennal sockets nearly twice as far from one another as from eyes. Eyes

about twice as near together ventrally as on vertex, in contact with clypeus for a long stretch. Ocelli small, in a triangle with posterior side somewhat the longest, hind ocelli separated by three and a half diameters, POL : OOL = 2 : 1. Occiput strongly margined, its width behind the eyes dorsally two-thirds distance between posterior ocelli; tempora about one-quarter width of eye. Thorax + propodeum not quite twice as long as broad, surface with very large, not very close punctures, interstices shining, mesonotum duller with some very fine punctures between the large ones. Pronotum with anterior margin strongly raised and reflexed, preceded by a moderately deep furrow, the posterior edge of which is subacute but not at all overhanging; no lateral fovea; keel very strong, concave anteriorly, angles projecting as lobes. Anterior margin of proepisternum very strongly raised and reflexed; sides completely margined, strongly in front. Prepectal furrow not developed. Upper division of metapleuron only feebly produced along meso-metapleural suture. Tegulae shining, unpunctured, outer edge regularly curved. Postscutellum somewhat flattened but in profile not forming a quite continuous curve with scutellum. Propodeum with central furrow weak and very ill defined, dorso-lateral margin of valve-plate obtuse. Mid tibiae with one spur. Mid and hind tarsi broken but probably as in *M. buyssoni* (Ducke). Length of fore-wing 8·5 mm.; hamuli 8. Abdominal petiole extremely long (about as long as hind femur + trochanter) and parallel-sided, distally scarcely at all expanded, spiracular ratio = 3 : 4, spiracles distinctly projecting, petiole ventrally with membranous emargination shallow. Tergite 2 strongly expanded, about twice as broad as long.

♂. Not seen (see below).

Specimen examined :—Type, Brazil : ♀ (F. Smith coll.) (B.M.).

The specimen in the British Museum marked as type has the correct data and agrees with the original description. It is, however, a female whereas Saussure described a male. I think it is possible that Saussure mistook the sex. There is, at least, no doubt that this is his *P. filiformis*. Ducke (1904 : 360; 1905 : 687) found a small nest near Pará, but he does not describe it.

Mischocyttarus buyssoni (Ducke).

Monacanthocnemis buyssoni Ducke, 1906a : 9.

♀. Black; mandibles and antennae beneath, *rufous*; narrow, more or less interrupted posterior orbital margin, small spot on each side of clypeus, fairly broad margin to near centre of eye-emargination, a dot at top of inner orbits, minute spot on dorsal margin of each antennal socket, feeble margin to pronotum, ventral tip, and angles of pronotal keel, minute spot each side of scutellum, axillae and post axillae, small prepectal suture, greater part of mesosternum, narrow, broadly interrupted margins to tergites 2–4, margins to sternites 2–5, *yellow*. Legs black or reddish-black with the following *yellow* marks : fore coxae (rest of fore legs missing), mid coxae ventrally, anterior surface and posterior streak on mid and hind femora, mid and hind tibiae anteriorly and distal fourth posteriorly, hind coxae rufous beneath with an extero-dorsal streak. All tarsi yellow-brown. Tegulae dark testaceous, proximally darker. Wings hyaline, with a slight yellow tinge, especially along the costa. Surface of head and thorax with appressed silvery pubescence and numerous, outstanding, blackish bristles; legs and abdomen (except beneath) with very fine pubescence. Sternite 6 with rather dense, black, outstanding pubescence. Length (H. + Th. + T1 + T2) 10·0 mm.

Head dull, clypeus more shining with sparse large punctures, vertex with dense, minute punctures and sparse large ones amongst them. Mandibles moderately shining, with sparse large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest almost quite obliterated. Width of clypeus where eyes approach most closely about two-thirds its length, ventral margin very weakly and roundly produced, not impressed or differently sculptured (only a little more shining). Tentorial

pits more than twice as far from antennal sockets as from eyes. Antennal segment 3 hardly longer than 1. Antennal sockets nearly twice as far from one another as from eyes. Eyes not quite twice as near together ventrally as on vertex, in contact with clypeus for a long stretch. Ocelli small, in a triangle with posterior side somewhat the longest, hind ocelli separated by two diameters, POL : OOL = 4 : 3. Occiput strongly margined, its width behind eyes dorsally about two-thirds distance between posterior ocelli; tempora about one-quarter width of eye. Thorax + propodeum about twice as long as broad, surface moderately shining, with finer punctures and numerous moderately large punctures amongst them, mesonotum duller since the finer punctures are a little larger and much closer. Pronotum with anterior margin strongly raised and reflexed, preceded by a moderate furrow, the posterior edge of which is subacute in centre and preceded itself by a deeper and broader depression; no lateral fovea; keel very strong, concave anteriorly, angles projecting as lobes. Anterior margin of procpisternum strongly raised and reflexed; sides completely margined, strongly in front. Prepectal furrow scarcely developed. Upper division of metapleuron only feebly produced along meso-metapleural suture. Tegulae shining, unpunctured, outer edge regularly curved. Postscutellum somewhat flattened but in profile not forming a quite continuous curve with scutellum. Propodeum with central furrow broad, rather deep and well defined, ending dorsally one-fifth its length from postscutellum, dorso-lateral margin of valve-plate obtuse. Mid tibia with one spur, segment 3 of tarsi little asymmetrical. Hind tarsi with inner distal angle of segments 3 and 4 strongly produced, inner lobe of 3 a little longer than outer lobe of 4 which is half as long as its inner lobe, claws moderately asymmetrical. Length of fore-wing 10·0 mm.; hamuli 9. Abdominal petiole moderately long (as long as hind femur), sides gradually diverging in posterior half, posterior about twice as wide as anterior margin, spiracular ratio = 4 : 5, spiracles not strongly projecting, petiole ventrally with membranous emargination shallow. Tergite 2 moderately expanded, about as broad as long.

♂. Not seen.

Specimen examined :—Brazil : Rio de Janeiro, 7.xii.1906, ♀ (*A. Ducke*) (B.M.).

This specimen is marked as type, as appears always to be the case with specimens distributed by Ducke; it is, perhaps, a paratype. The holotype is in the Museu Goeldi.

Ducke (1906a : 9; 1907 : 183, pl. 3, fig. 8) has figured and briefly described a nest of this species found beneath a *Magnolia* leaf, near Rio de Janeiro. The nest has about twelve cells, in about three rows, the central cells complete, the others very small. The petiole is strongly eccentric.

Mischocyttarus punctatus (Ducke).

Megacanthopus punctatus Ducke, 1904 : 363.

♀. Head *black*; most of mandibles, malar space and whole outer orbit, clypeus (except narrow, wedge-shaped, central black mark on dorsal two-thirds), inner orbits to top of eye-emargination, two spots forming a very widely opened V just above antennae, *pale yellow*; teeth and ventral margin of mandibles, ventral margin of clypeus, antennae beneath, *ferruginous*; pronotum ferruginous, darker in front of keel and on anterior part of dorsal lobes, keel and posterior margin pale yellow, mesonotum black, scutellum pale yellow with narrow posterior border and axillae black, postscutellum pale yellow with postero-discal black mark, propodeum black with very large, oval, yellow marks (covering most of its length though not quite reaching postscutellum) on each side of furrow, meso- and metapleuron ferruginous, mesepisternum postero-dorsally and area at dorsal margin of mesosternum black, dorsal half of prepectus and postero-ventral corner of mesepisternum pale yellow; legs ferruginous (in parts nearly black), lateral streak on fore coxa, small distal mark on fore femur, postero-discal streak on fore tibia, inner anterior spot outer dorsal

streak on mid coxa, distal spot on mid femur, dorsal streak on mid tibia, two dorsal streaks on hind coxa, sometimes dorsal streak on hind tibia, pale yellow; abdomen blackish-brown, posterior fifth and sometimes anterior third of tergite 1, narrow posterior bands on tergites 2–5, whole ventral surface or at least distal third of sternite 1, posterior, discally broadened bands on sternites 2–5, pale yellow. Tegulae testaceous, posterior corner yellow. Wings hyaline, venation brown. Surface of head, thorax and propodeum with short, mostly erect, moderately close, pale pubescence; legs and abdomen with short, pale appressed pubescence, tarsi and hind tibiae also with short bristles; abdominal segment 1 with less pubescence and more shining than rest of abdomen which is dull; sternite 1 with sparse outstanding pubescence beneath, tergites 5–6 with dense, outstanding, pale pubescence. Length (H. + Th. + T1 + T2) 9·0 mm.

Head moderately shining, clypeus and depression in front of median ocellus somewhat duller, vertex with moderately close and large punctures, clypeus with close minute punctures and scattered large ones. Mandibles moderately shining, with sparse large punctures, proximal half ventrally flattened and ventrally somewhat sharp-edged, four distal teeth. Malar space at narrowest hardly one-quarter width of antennal socket. Width of clypeus where eyes approach most closely a little less than its height, ventral margin moderately but hardly angularly produced over its central two-thirds, not impressed but with fewer large punctures. Tentorial pits little closer to eyes than to antennal sockets, well removed from both. Antennal segment 3 a little longer than 1. Antennal sockets about twice as far from one another as from eyes. Eyes ventrally separated by two-thirds as much as on vertex, in contact with clypeus for a long stretch. Ocelli of moderate size, in an equilateral triangle, hind ocelli separated by rather less than two diameters, POL : OOL = about 1. Occiput strongly margined, its width behind eyes dorsally about one and a half times POL. Tempora about one-third width of eye. Thorax + propodeum about twice as long as broad, surface shining, with not very close, large punctures, mesonotum with numerous punctures about half as large amongst them, remainder with very minute punctures between the large ones. Pronotum with anterior margin very strongly raised and reflexed, preceded by a furrow the posterior edge of which is obtuse; no lateral fovea; keel very strong, concave anteriorly since central part is somewhat bent backwards and flattened, angles projecting as lobes. Anterior margin of proepisternum moderately raised but not reflexed; sides weakly margined. Prepectal furrow scarcely developed. Upper division of metapleuron only feebly produced along meso-metapleural suture. Tegulae shining unpunctured, outer edge regularly curved. Postscutellum flattened, forming an almost continuous curve with scutellum. Propodeum with central furrow shallow not well defined, rather narrow, not quite extending to postscutellum; dorso-lateral margin of valve-plate obtuse. Mid tibia with two nearly equal spurs; segment 3 of mid tarsi little asymmetrical. Hind tarsi with inner distal angle of segments 3 weakly, of 4 strongly produced, inner lobe of 3 little longer than outer lobe of 4 which is about half as long as its inner lobe, claws only moderately asymmetrical. Length of fore-wing 7·0–8·0, average 7·6 mm.; hamuli 8–9, average 8·5. Abdominal petiole long and narrow, fully as long as hind femur + trochanter, almost parallel-sided to spiracles, then diverging a little but becoming parallel again, posterior about twice as wide as anterior margin, spiracular ratio = 6 : 5, spiracles moderately to rather strongly projecting, petiole ventrally with membranous emargination little more than twice as wide as deep. Tergite 2 moderately expanded, as broad as long.

♂. Not seen.

Specimens examined :—B.W.I., Trinidad : ♀ (B.M.). Brazil : Trombetas, R. Curuina-mirina, 13.xii.1906, ♀ (*A. Ducke*) (B.M.) [det. Ducke], R. Trombetas, ♀ (Ducke) (Mus. nat., Paris). Paraguay : San Bernardino, 2 ♀ (*K. Fiebrig*) (B.).

Ducke described this species from Brazil : Maranhão, Alcantara, but it seems to be widely spread and little variable.

The remarkable nest of this species was first described by Ducke (1907 : 189, pl. 3, fig. 9; 1914 : 316–7, fig.) from N.W. Brazil. The nest was hanging beneath the roof of a hut, resembling exactly a dry twig. This is because each cell is attached to the lip of the one before, so the nest takes a thread-like, somewhat zigzagging course. A nest of 24 cells had 5 females. FitzGerald (1938 : 183–4) found similar nests in Trinidad. The first cell was attached to a rootlet by a 1·0-cm. petiole, the cells being 12·0 × 3·0 mm. Larger nests resemble twigs and are very inconspicuous. According to FitzGerald, the wasp closely resembles in colour the comparatively harmless *Polybia occidentalis* (Ol.). Strand (1912 : 321) also describes a nest from Paraguay.

Two other species have been described which make exactly similar nests, viz. *M. ypiranguensis* Pinto da Fonseca (1926) and *M. mirificus* Zikán (1935). Unfortunately, it is impossible to place these species in their species groups from the descriptions alone (and cf. *M. oecothrix* Rich., p. 449).

Subgenus *Monogynoecus* Richards, 1941 (text-figs. 74–5).

Type *Mischocyttarus lecointei* (Ducke, 1904) (original designation).

The characters of the adults are described in the key, p. 308. The ♂ genitalia (figs. 74, 75) are markedly distinct in this group and quite unusually so for this genus. The parameral spine, seen from the inside, is unusually thick in middle and sinuate; it bears numerous long bristles at the middle. The digitus and its mesal ramus are small but the latter is produced into a long inner process; the membranous part of the digitus is broad. The cuspis bears long but not very dense bristles. The aedeagus is broad and quite abnormal. The posterior extremity is broad, the tooth-bearing part short, the teeth (13–17 in number) very long and thin, going right up to the base of the very strong acute hook which projects laterally, not ventrally. The hook is widely separated from the point at which the spatha is emitted. The apodemes are short, and are bent and widened near the point of attachment to the body of the aedeagus.

Larva. Reid (1941 : 320, figs. 115, 123, 128) has described the larvae of *M. lecointei* (Ducke) and *M. metoecus* Rich. There are two lobes on the first abdominal sternite and these are pointed and diverging. There are no bristles on the ventral surface, except on the lobes, and the tenth abdominal segment bears a dorsal knob. The bristles on the ventral lobes are distally thickened and truncate in *M. metoecus* and tapering as usual in *M. lecointei*. It is interesting to find that the larvae of such closely allied species are so well differentiated.

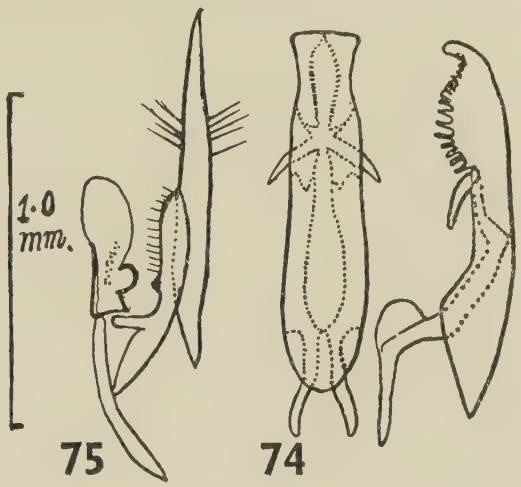
Nest. Most of the nests of *M. lecointei* and *M. metoecus* which I found were on myrmecophytes inhabited by ants, otherwise they have very little in common. *M. lecointei* and *M. foveatus* make a comb of a number of rows of cells supported by an eccentric petiole. *M. metoecus* makes a long fan-shaped comb of one or two rows supported by a central petiole. All three species seem to fasten their eggs nearer to the bottom of the cell than is usual in the genus.

Mischocyttarus lecointei (Ducke).

Megacanthopus lecointei Ducke, 1904 : 361.
? *Polybia ostenta* du Buysson, 1908 : 217.

♀. Colour pattern described under the varieties. Head and dorsal surface of thorax and propodeum with close, short appressed pale pubescence, pleura nearly bare, clypeus with outstanding bristles; legs and abdomen with microscopic appressed pale pubescence, tibiae and tarsi also with short reddish bristles; abdominal petiole at sides and beneath with rather sparse outstanding pale pubescence, other sternites with short pubescence which becomes longer and outstanding on 5–6. Length (H. + Th. + T1 + T2) 8·0–10·0 mm.

Head smooth, moderately shining, a little duller in front of ocelli, clypeus with sparse large punctures on ventral half. Mandibles shining, with sparse large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest about one-quarter as long as width of antennal socket. Width of clypeus where eyes approach most closely three-quarters its length, ventral margin not depressed, rather strongly, obtusangularly produced over three-quarters its width. Tentorial pits twice as far from antennal sockets as from eyes, well removed from both. Antennal sockets one and a half times as far from one another as from eyes. Antennal segment 3 hardly as long as 1. Eyes separated ventrally by two-thirds as much as dorsally, in contact with clypeus for a long stretch. Ocelli in an equilateral triangle, separated from one another by a little less than diameter of one, POL : OOL = 1 : 3 or 1 : 2·5. Occiput not margined, its width behind eyes dorsally a little more than twice POL. Tempora not quite half width of eye. Thorax + propodeum about twice as long as broad, smooth and rather shining,



Figs. 74–5.

FIG. 74. *M. lecointei* (Ducke) var. *guianensis* var. n. ♂. Aedeagus, dorsal view and view from right side.

75. The same, left volsellar plate and parameral spine, ventral view.

dorsal aspect duller. Pronotum with anterior margin little raised, preceded by a shallow furrow of which posterior edge is obtuse; no lateral fovea; keel absolutely obtuse and only just traceable, straight in dorsal view. Proepisternum with anterior margin little raised and reflexed, sides hardly margined. Prepectal furrow distinct. Upper division of metapleuron acutely produced along meso-metapleural suture. Tegulae shining, almost unsculptured, lateral margin in a not quite regular curve. Postscutellum strongly flattened, its anterior margin in same plane as scutellum. Propodeum with no anterior horizontal region, central furrow very weak but nearly complete, with traces of central keel ventrally. Mid tibia with two spurs of equal length. Mid tarsi with segment 3 almost symmetrical, segment 4 rather strongly produced. Hind tarsi with inner lobe of segment 3 not more produced than outer lobe of segment 4, the outer edge of which is two-thirds as long as its inner edge; segment 5 two-thirds as long as 2, claws very little asymmetrical, larger one sharp. Abdominal petiole about as long as hind femur, sides very slightly diverging to beyond spiracles, then becoming parallel, posterior rather more than twice as wide as anterior margin, spiracular ratio 1 : 2·5, spiracles moderately projecting; petiole ventrally with membranous emargination two and a half times as wide as deep. Tergite 2 as long as wide.

♂. Resembles ♀ except in following particulars:—clypeus with appressed silvery pubescence; sternites 6–7 with dense outstanding pubescence; length (H. + Th. + T1 + T2) 8·5–9·5 mm.; mandibles more shining, unpunctured, four distal teeth, decreasing considerably in size dorsally; ventral margin of clypeus less produced; tentorial pits almost three times as far from antennal sockets as from eyes; antennae with segment 3 as long as 1+ 2, a little longer than 4 + 5, five times as long as broad, 4–10 becoming progressively shorter but hardly thicker, 4 not quite twice, 10 once as long as broad, 11–12 successively a little thinner than 10, 13 three times as long as broad, as long as 5, antennae with last segments somewhat spirally rolled, no segment ciliate, none with a shining area; posterior margin of sternites 4–6 hyaline, but not or hardly reflexed, 7 flattened.

Mischocyttarus lecointei var. *lecointei* (Ducke).

♂♀. Head brownish-yellow, mandibles, ventral third of clypeus and orbits paler; margins of mandibles and ventral margin of clypeus pitchy; cloud on dorsal side of antennal segment 1, ocellar mark, broadly produced in front of ocelli but becoming nebulous and fading away half-way to antennal sockets, mark including an elongate yellow spot between ocelli, lateral wings distinct, occipital mark, not including a yellow spot, extending half-way along tempora to mandibles, broadly joined to ocellar mark and narrowly to posterior corner of eye, black; thorax and propodeum brownish-yellow, clearer yellow on scutellum, central part of propodeum and upper part of pleuron; pronotum with transverse stripe two-thirds as broad as head, in front of keel and stripes on dorsal lobes black; mesonotum black, two discal yellow stripes separated by more than twice their width, abbreviated lateral stripes hardly developed, situated on actual margin; scutellum with narrow anterior and posterior black margins and a brown discal cloud of which anterior margin is rounded or angular; postscutellum with narrow posterior black margin; propodeum with central stripe and antero-lateral triangles black; mesopleuron with spot in hollow beneath fore-wing, dorsal furrow, and centre of meso-metapleural suture black; legs brownish-yellow, dorsal stripes on mid and hind coxa and distal mark on their tibiae paler; abdomen brownish-yellow, tending to be paler ventrally, tergites and sternites posteriorly with narrow yellower bands more or less indicated. Tegulae testaceous. Wings a little brownish, especially along costa, pterostigma brown. Length (H. + Th. + T1 + T2) 8·0–10·0 mm. Dorso-lateral margin of valve-plate of propodeum ♀, acute (21 spec.), subacute (18 spec.) or obtuse (12 spec.; one spec. damaged), ♂, acute (4 spec.), subacute (2 spec.) or obtuse (1 spec.). Length of fore-wing ♀, 10·0–12·0, average 11·1 mm., ♂, 9·0–11·0, average 10·2 mm. Hamuli ♀, 6–10, average 8·9, ♂, 7–10, average 8·6. ♂ genitalia described p. 406, aedeagus with 15 ventral teeth.

Specimens examined:—British Guiana: Potaro Valley, path from Tukeit to Kaieteur, 1.ix., 2 ♀ (including nest 140), 3.ix., 16 ♀, 2 ♂ (nests 174–9), 4.ix., 5 ♀ (nests 190, 192), 6.ix., 1 ♀ (nest 218), 9.ix., 1 ♀ (nest 229), 10.ix.1937, 17 ♀ (nests 238–41, 243, 245–8) (*Richards and Smart*) (B.M.), Kaieteur Savannah, 8.ix.1937, ♂ (*Richards and Smart*) (B.M.), Kaieteur, 14.viii.1911, ♂ (J.B.), Tukeit, 20.vii.1911, ♀ (J.B.), Amatuk, 31.viii.1937, 2 ♀ (nest 152) (*Richards and Smart*) (B.M.), Warratuk, 12.ix.1937, ♂♀ (nest 135) (*Richards and Smart*) (B.M.); Mazaruni R., Kartabo, vi.1922, ♀ (*M. D. Haviland*) (B.M.); Upper Courentyne R., ix.1935, 2 ♀ (*G. A. Hudson*) (B.M.). Brazil: Guiana, Oyapock, 3.vi.1904, ♂ lectotype (*A. Ducke*) (B.M.), ♀ (B.), R. Javary, 13.vii.1906, ♀ (*A. Ducke*) (B.M.); Bahia, ♂ (*Sellow*) (B.). S. America: ♀ (B.).

Ducke described *M. lecointei* from Obidos, Camahipy and Oyapock. He did not designate a type specimen nor did he state in what collection the type would be deposited. I therefore fix the above male from Oyapock as lectotype; it is probably one of the original syntypes.

Mischocyttarus lecointei var. **guianensis** var. n.

♂♀. Resemble var. *lecointei* except :—yellow brighter, less brown-tinged; dark anterior parts of abdominal tergites black or dark brown, contrasting sharply with narrow posterior yellow bands, sternites pale yellow; length (H. + Th. + T1 + T2) ♀ 8·5–10·0 mm., ♂ 9·0 mm.; dorso-lateral margin of valve-plate of propodeum, ♀, acute (1 spec.), subacute (3 spec.) or obtuse (3 spec.); ♂, acute or subacute; length of fore-wing, ♀, 10·0–11·0, average 10·4 mm., ♂, 10·0, 10·0 mm.; hamuli, ♀, 6–10, average 7·7, ♂, 5, 8. ♂ genitalia (figs. 74, 75) differ from var. *lecointei* in having the tip of the adeagus less rounded, 17 ventral teeth.

Specimens examined :—British Guiana : north bank Essequibo R., Moraballi Creek, Wallaba (*Iperua*) bush, 23.ix.1929, type ♀, allotype ♂ (nest 2691) (*Oxford Univ. Exped.*) (B.M.), same place and collection as type, paratypes, 19.ix., 3 ♀ (2312, 2339), 23.ix., ♀ (2692), ♂ (2691), 25.ix., ♀ (2863), 1929, ♀.

These Moraballi specimens come from a different watershed to the Kaieteur ones.

Polybia ostenta du Buysson, 1908, was described from a female, French Guiana : Nouveau Chantier du Bas Maroni (*E. Le Moult*). Ducke (1918 : 354) synonymised it with *Mischocyttarus lecointei* (Ducke, 1904) and, at the very least, it belongs to this group. When I examined the material in the Paris Museum, I failed to find the type of *P. ostenta*, but unfortunately I searched under *Polybia* and not under *Mischocyttarus*. As Ducke did not separate the three species of the group recognised in the present paper, the synonymy is doubtful.

The larva of *M. lecointei* is described on p. 406.

Ducke (1905 : 687, pl. 4, fig. 20) records that *M. lecointei* appears to live exclusively in the neighbourhood of water, along edges of streams, etc., in the States of Pará and Amazonas. He figures a nest with a comb of four rows of about 18 cells with a nearly central petiole. Later (1907 : 189), however, he states that the petiole is eccentric in large nests.

I have examined twenty-three nests (pl. 3, figs. 156–160) of the typical variety of *M. lecointei*. Fifteen of them (nos. 174–8, 192, 229, 239–41, 243, 245–8) were found attached beneath the mid-rib of a leaf of the Boraginaceous shrub, *Cordia nodosa* Lam., British Guiana : Potaro R., Tukeit–Kaieteur trail, 3–10.ix.1937. Two others on the same plant in the same district; no. 135, Warratuk, 12.ix.; no. 152, Amatuk, 31.viii. The other six nests were found as follows :—same place, no. 140, on mid-rib beneath leaf of one of the Scytamineae, 1.ix.1937; nos. 179, 190 and 218, on mid-rib beneath leaf of unidentified shrub, 3–4.ix.1937; no. 238 beneath leaf of Aroid, 10.ix.; no. 418, beneath mid-rib of leaf of small tree, British Guiana : R. Mazaruni, Kartabo, 1.viii.1922 (*M. D. Haviland*).

The nests were not found specially near water, and most of them occurred in dry places. During the ten days spent in the Kaieteur district, 8 other *Mischocyttarus* nests belonging to six species were found, but none of them on Cordia. In this plant there is a preformed cavity in the base of the mid-rib of the leaf in which small yellow ants, *Allomerus 8-articulatus* Mayr var. *demerarae* Wheeler always nest.

The carton of which the nests are made may be entirely dark (7 nests) or mainly dark with a few light bands on some cell walls (6 nests) or evidently bicoloured with large pale and dark areas (10 nests). Both colours seem to be due to wood-fragments, the light part being made of small and oval pieces and the dark part of fragments which are usually more elongate. There is little varnish on the comb and no " windows " are left in the walls. The eccentric

petiole is much more heavily varnished and is about 4·0 × 2·0 × 1·0 mm., being flattened in the plane of the longer axis of the comb. The attachment plate is usually rather large, forming a saddle over the mid-rib of the leaf, perhaps 6·0 mm. long. The cone of attachment is little developed. Distal surface of the comb is very irregular, owing to some cells being completed when others are small. The cells are arranged in two rows at an angle of 60° with one another and the completed cells are 12·0 × 3·5 mm. The eggs are fastened to the bottom of the cell on the side nearest to the petiole. The cocoon caps are attached at the distal ends of the cells and are considerably domed. They are made of brown fibrous silk, plastered with lines of wood-fragments. The following table summarises the data of 22 nests of *M. lecointei*.

Table 4.

Nest no.	Rows of cells	Total no. cells	No. wasps	Eggs	Larvae	Pupae	Empty	Remarks
179	4, 6, 7 P. (2 C.), 8 (3 C.), 8 (3 C.), 7 (1 C.), 5, 3							3 cells with 2, 1, 1, empty Phorid pupae
	3, 4, 6, 7, 7, 7 P., 6, 5, 3	48	5 ♀, 1 ♂	6	10	9	23	wasps dissected, see below.
152	3 P., 4, 5, 6, 5, 3	26	2 ♀	13	7	0	6	Only a few cells nearly complete.
	4 P., 5, 5, 5, 4, 3							
238	4 P. (1 C.), 4 (1 C.), 5 (2 C.), 5, 4, 2	24	3 ♀ +1 wasp lost	11	8	4	1	
	4 P., 5, 6, 6, 3							
174	4 P., 4, 5, 5, 4, 1	23	2 ♀	14	8	0	1	
	4 P., 5, 5, 6, 3							
248	4 P., 5 (1 C.), 5, 3	17	2 ♀	10	6	1	0	
247	4 P. (1 C.), 5, 4, 3	16	1 ♀, 1 lost	8	7	1	0	
245	4 P., 4, 4, 1	13	2 ♀	9	4	0	0	No cell complete.
140	3 P., 4 (2 big cells), 3	10	1 ♀	6	2	0	0	
229	2, 3 P., 3, 1	9	1 ♀	5	4	0	0	
246	2, 3 P., 2, 1	8	1 ♀	4	3	0	1	
240	3 P., 3, 2	8	2 ♀	6	2	0	0	
241	2 P., 3, 2	7	1 ♀	5	2	0	0	
176	2 P., 3, 1	6	1 ♀	5	0	0	1	
177	2 P., 3, 1	6	1 ♀, 1 lost	5	0	0	1	
239	3 P., 2	5	1 ♀	5	0	0	0	
178	2 P., 2	4	1 ♀	4	0	0	0	
192	2 P., 1	3	1 ♀	3	0	0	0	
135	2 P., 1	3	1 ♀	3	0	0	0	
175	2 P., 1	3	1 ♀	2	0	0	1	
190	—	3	2 ♀	2	0	0	1	
218	—	3	1 ♀	2	0	0	1	
243	—	2	1 ♀	0	0	0	2	

P. indicates the row in which the petiole is situated. C. with a number indicates how many cocoons are in a row. In the 4 largest nests, the rows are shown in the two directions to fix the position of the petiole. The number of wasps on the nest when taken (not including subsequently bred out) is a minimum, as some may have been foraging.

The five females from nest 179 and the three from nest 238 were preserved in alcohol. Dissection was not possible while we were at Kaieteur and in the preserved specimens dissected later, it was not possible to identify sperm in the spermatheca, as can easily be done in freshly killed specimens. Thus it is possible that in both these nests only one female was fertilised and the other was a young queen which had not yet left the nest. On the whole, it is more likely that *both* queens were fertilised.

On dissection, the queens are easily distinguished by the presence of ripe eggs, which are very much larger than any eggs seen in the worker ovaries. The following table gives the particulars of these females and workers, which did not otherwise differ in colour, structure or size.

TABLE 5.

Nest no.	Caste	Ovary	Hamuli	Length fore-wing, mm.	Condition of propodeal valve-plate
179	♀	6 ripe eggs	9	11·0	Subacute
	♀	5 „	10	11·5	„
238	♀	6 „	8	11·0	„
	♀	6 „	9	11·5	Acute
	Mean	—	9·0	11·25	—
179	☿	None ripe	10	10·5	Subacute
	☿	„	10	10·5	Acute
	☿	„	10	11·0	Obtuse
238	☿	„	10	11·0	Acute
	Mean	—	10·0	10·75	—

These figures are insufficient to show whether the smaller number of hamuli and longer fore-wing of the queen are significant. It is possible that they are, since in *Polybia occidentalis* (Oliv.), in a much longer series of queens and workers the same differences were found. In *M. superus* Rich. (p. 425), however, the relation seems to be reversed.

A study of Table 4 shows that pupae are not present in nests with less than 16 cells, nor larvae present in those with less than 7 cells. This shows the relative growth-rates of comb and insect and also shows a marked difference from most other Polybiines, which build a large number of cells first and then lay eggs in them, e.g., in *P. occidentalis* (Oliv.) as many as three combs, several hundred cells in all, may be constructed before any eggs are laid. This difference is due to the presence in a *Mischocyttarus* nest of only one or at most very few egg-laying females, so that cells are only built as eggs ripen. Moreover there is usually only one or at most two females to do the building. In *Polybia*, on the other hand, there are many egg-laying females and many workers for building and even the hundreds of cells will be filled with eggs within a day.

Table 4 also shows that colony-formation, though usually performed by one queen, may also be undertaken by a small swarm, analogous to the much larger swarms of other Polybiines. Whether the second wasp in nests 245, 240, 177 and 190 was another queen or a worker is not known; probably the latter. But at any rate the presence of two wasps on a nest which has not yet produced any cocoons is proof of swarming. The alternative supposition that two strange females should join together at some stage to build a common nest is very much less likely, though Rau (1933) has observed it in *Polistes canadensis* var. *panamensis* Holmgr., in Panama. If the wasps all come from the same nest but arrive on different days, the behaviour is not really very different from swarming.

Two small nests (pl. 1, figs. 125–6) of variety *guianensis* have been examined, nos. 2312 and 2339, both from Moraballi Creek, ix.1929. Both were attached to the underside of leaves and the cells vary much in size. There is no obvious difference from the nest of the typical form.

Mischocyttarus metoecus Richards, 1940 : 181.

♀. Closely resembles *M. lecointei* (Ducke), except in the following particulars :—entire clypeus yellow; black ocellar mark very little produced in front of ocelli, more nebulous; black mark on antennal segment 1 very small, distal; black mark in front of pronotal collar only one-third width of head; legs yellower; length (H. + Th. + T1 + T2) 8·5–10·0 mm.

Pronotal keel little raised but distinctly sharp throughout, dying away gradually at

sides, a little convex anteriorly; upper division of metapleuron tending to be more obtuse below; dorso-lateral margin of valve-plate of propodeum acute (7 spec.), subacute (3 spec.) or obtuse (1 spec.); length of fore-wing 9·5–11·5, average 11·0 mm.; hamuli 7–11, average 8·5.

♂. Differs from *M. lecointei* (Ducke) in same way as ♀; length (H. + Th. + T1 + T2) 8·0–9·0 mm.; dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 9·0 mm.; hamuli 7, 10. Genitalia similar.

Specimens examined :—British Guiana : Mazaruni Settlement, second-growth forest, 14.ix.1937, 6 ♀ including type (nests 261, 262, 263), 24.ix.1937, ♀ (nest 319), 25.ix.1937, ♀ (nest 337) (*Richards and Smart*) (B.M.); Potaro R., Amatuk, 31.viii.1937, 2 ♀, ♂ allotype (nest 148) (*Richards and Smart*) (B.M.). Dutch Guiana : near Paramaribo, iii.1909, ♀ (*C. Heller*) (B.). Brazil : Amazonas, Barcellos, 23.vi.1905, ♂ (*A. Ducke*) (B.) [det. as *M. lecointei* by Ducke].

The female from Paramaribo differs in having the dark triangles on the propodeum pale brown and the dark parts of abdominal tergites 2–6 almost black. The male from Barcellos differs in having the antennae almost entirely dark brown dorsally, in having the yellow mesonotal stripes considerably broader, in having no dark triangles on propodeum and in having the dark parts of the abdominal tergites dark brown.

Some of the paratypes have been deposited in my and in Dr. J. Bequaert's collections.

The larva of *M. metoecus* is described on p. 306.

Five nests (pl. 1, figs. 137–9; pl. 3, figs. 166–9) of this species have been studied. No. 148, R. Potaro, Amatuk, 31.viii.1937, under leaf of Bromeliad, *Brocchinia micrantha*. Nos. 261–3, Mazaruni Settlement, second-growth forest, 14.ix.1937, attached beneath mid-rib of leaves of one tree of *Casearia* sp. (Flacourtiaceae) (pl. 4, fig. 185) inhabited by a large colony of the ant *Azteca* sp. near *velox* For. (det. Donisthorpe). No. 319 was found on the same tree on 25.ix.1937. No. 337, Mazaruni Settlement, second-growth forest, 25.ix.1937, attached beneath the mid-rib of *Cordia nodosa* Lam. (Boraginaceae), in the chambers of whose leaves live the ants, *Allomerus 8-articulatus* Mayr var. *demerarae* Wheeler.

Thus this species has the same tendency as *M. lecointei* (Ducke) to build on ant-trees, though their nests are in all other respects totally different.

The structure of the nests is best seen in the diagrams and photographs. There are one or two rows of cells which form a fan-shaped structure on each side of the central petiole. A comb of this sort is unique within the genus as far as is known.

No. 148 is a dark brown nest with some light brown patches. The carton is made of small mostly oval pieces of wood with very little varnish except on the petiole. There are a number of "windows" (holes) left in the walls especially of the larger cells. The petiole is 3·0 × 1·3 × 0·75 mm., flattened in the direction of the long axis of the nest. The attachment-plate is circular, 3·0 mm. diam., with no buttresses to the petiole. The cone of attachment is only moderately developed. The petiole is set obliquely to the cells, the rows of which are quite sharply angled at its point of attachment. The cells come to lie in the horizontal plane. The proximal surface of the comb is in general flat, but strongly mammillated at each cell, and at one cell with a small spinose projection. The completed cells are 13·0 × 3·5 mm. The cocoon-cap is considerably domed, of brown fibrous semi-transparent silk, with the strips of wood-fragments crossing it raised into high keels. There are two rows of 22 cells in

all which contained 12 eggs, 7 larvae and 2 cocoons, while one was empty. Two females and a male were seated on the comb.

No. 261 is made of paler coloured carton with many elongate wood-fragments. The cell walls have many " windows " and nearly every cell has a small spinose projection from its proximal end. The petiole is 3·0 × 2·0 × 1·0 mm., flattened in the direction of the mid-rib of the leaf and of the long axis of the comb, and at nearly a right angle with the sides of the comb. The main row of 16 large cells contained 3 eggs, 8 larvae and 5 cocoons, while 7 pocket-like structures at the sides of some of the cells were empty but showed that new cells were being constructed. Two female wasps were present. No. 337 is another nest with perforated, proximally spinose cells. There are 13 cells which contained 7 eggs and 6 larvae; one female was on the comb. Although the comb is so irregular, it seems certain that no cells were being used a second time. The eggs are nearly always attached to the bottom of the cells on the side nearest the ground. No. 262 has a single row of 7 cells containing 2 eggs, 4 larvae and one cocoon. Two wasps were present. The comb is neither perforated nor proximally spinose. No. 263 is a nest of 7 cells very similar to No. 262. It contained 3 eggs, 1 larva and 1 cocoon and one female wasp was present. The cocoon later produced an Ichneumonid (*Mesostenus* sp. ♂, near *M. cassunungae* Brauns), which, it was found, had spun a white cocoon inside that of the wasp. No. 319 is a nest of two cells, one containing an egg. One wasp was present.

It seems clear that in nests 261 and 262 no wasps had hatched out of the comb and that the colony must have been founded by two wasps. In nest 148 it is possible that some of the cells were being used a second time, though the haphazard way in which certain cells are larger than others seems to be characteristic of this species.

Mischocyttarus foveatus Richards, 1941 : 130.

♀. Closely resembles *M. lecointei* (Ducke), except in the following particulars :—ground colour somewhat browner; ocellar and occipital marks nebulous brown throughout, though same pattern is traceable ; dark pronotal marks nebulous or absent, mark in front of collar not more than half as wide as head; mesonotum brown, stripes not clear-cut, lateral ones very indistinct; dark cloud on disc of scutellum not developed; antero-lateral triangles and sometimes central stripe of propodeum brown or yellow-brown; dark pleural markings reduced; mid and hind femora darker dorsally; abdomen browner, posterior pale margins of tergites less distinct; length (H. + Th. + T1 + T2) 7·5–9·0 mm.

Ventral margin of clypeus tending to be somewhat more rounded; pronotal keel similar or a little stronger centrally (much weaker than in *M. metoecus* sp. n.), lateral fovea more or less indicated though very small and shallow, with a slight obtuse tubercle below it; whole thorax duller, pleuron not in the least shining; dorso-lateral margin of valve-plate of propodeum acute (5 spec.) or subacute (2 spec.); length of fore-wing 9·5–10·0, average 9·9 mm.; hamuli 8–9, average 8·6; abdominal petiole somewhat narrower, with sides straighter, less divergent on distal half.

♂. Brownish-yellow; antennae dorsally and ocellar and occipital marks black, ocellar mark produced to join a small black spot between antennal sockets, produced parts narrowing anteriorly, no lateral " wings," mark broadly joined to occipital mark; pronotum with spot in front of keel and dorsal stripes black, former one-third as wide as head; mesonotum black with four well-defined stripes, central pair separated by rather more than their width, lateral pair abbreviated in front; scutellum with anterior and posterior, postscutellum with posterior margin black; propodeum with narrow central black stripe; black pleural marks very reduced; legs as in *M. lecointei* (Ducke) but four hind femora antero-dorsally and segments 3–5 of four hind tarsi, darkened; length (H. + Th. + T1 + T2) 8·0 mm.

Differs structurally from *M. lecointei* (Ducke) as follows :—antennal segment 1 as thick as distance between antennal sockets (not two-thirds as thick), longer than 1 + 2, 11–12 not only thinner but also a little longer than 10, 13 four times as long as broad, a little longer than 4, segments 4–12 somewhat flattened and shining beneath, pronotal keel a little stronger, lateral fovea very small; thorax duller; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 9·5 mm.; hamuli 7; abdominal petiole with sides somewhat straighter. ♂ genitalia like those of *M. lecointei* (Ducke) but parameral spine with fewer bristles; membranous lobe of digitus longer, tip of aedeagus sclerotised, rounded, not truncate, ventral teeth 13, long and narrow but more regular.

Specimens examined :—British Guiana : Essequibo R., 1st Falls, 14.x.1929, ♀ type (nest 4070), same data, 3 ♀ (nest 4044), Essequibo R., island near Monkey Jump, 12.x.1929, ♀ (nest 3850), Moraballi Creek, dark forest, 11.xi.1929, 2 ♀ (nest 6241) (*Oxford Univ. Exped.*) (B.M.); North-west district, Issororo, vi.1915, ♂ allotype (*G. E. Bodkin*) (B.M.).

One nest (pl. 1, fig. 124), no. 4070 attached beneath a leaf, Moraballi Creek, 14.x.1929, is described below. It is made of whitish-grey carton, mostly made up of oval wood-fragments, lightly varnished and a little shining. The petiole is 1·5 × 1·0 × 0·5 mm., with very slight buttresses at the attachment-plate, which is 2·0 × 1·0 mm. The cone of attachment is very slight. There are 12 cells arranged in four rows in two directions, $\frac{2\text{ (2 C.) P., 4 (2 C.), 3, 3}}{3, 4\text{ P., 4, 1}} = 12$ (P. = petiole, 2 C. = 2 cocoons).

The smallest cells are farthest from the petiole and eggs are attached at the bottom of the cells on the side nearest to the petiole. Completed cells are 12·5 × 3·5 mm. The cocoon-caps are of brownish fibrous silk, attached flush with the distal end of the cell, distinctly domed, well plastered with wood-fragments. One wasp was present.

Subg. *Megacanthopus* Ducke, 1904.

Genotype *Megacanthopus collaris* Ducke, 1904, by designation of Bequaert, 1933.

The species of this subgenus seem rather closely allied, but those in the group of *M. collaris* Ducke are less close to the remaining species. The species are mostly rare in collections and more material is required of several of the species.

Nest. The majority of species make small combs of a rather triangular shape, the petiole being attached near one apex of the triangle, *i.e.* very eccentric. But two species in the group of *M. artifex* (Ducke) build a thread-like row of cells.

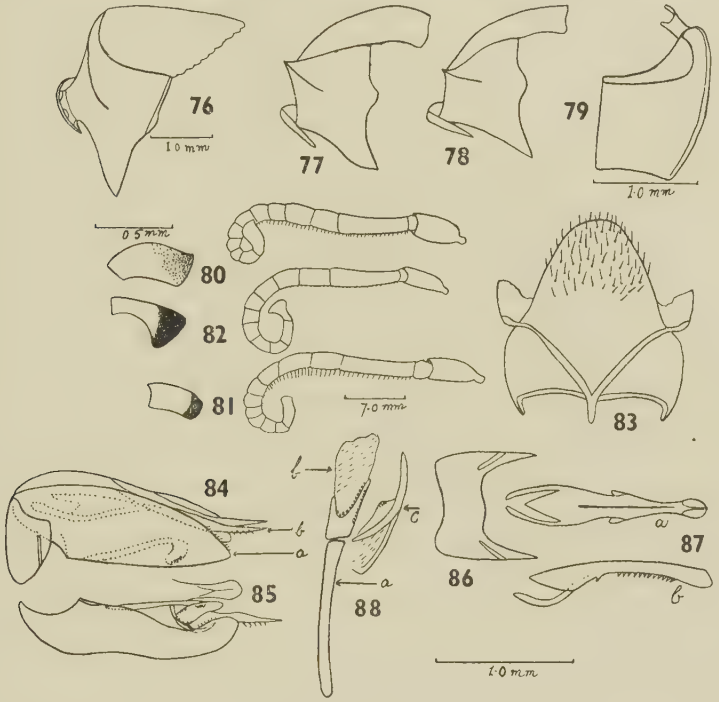
Larva. Reid (1941) described the larvae of seven species. All have two ventral lobes on the first abdominal segment and none have a knob on the tenth tergite. They differ from one another in colour and in the nature and arrangement of the bristles on the ventral surface.

Group of *M. collaris* (Ducke) (text-figs. 76–88).

Characters of the adults given in the key (p. 309). The male genitalia are here described in detail in *M. superus* (Rich.) as an example of the structure found in the genus. The nomenclature of the parts now used is that of Snodgrass (1941) but in my paper defining the species groups (Richards, 1941), I used the nomenclature of Peck (1937). The following homologies may be noted, Snodgrass' term being given first. Basal ring = gonocardo; paramere = gonostipes; parameral spine = gonocoxite. Digitus + cuspis = gonolacinia.

In general, the male genitalia seem more useful in *Mischocyttarus* for the definition of groups than for separating closely allied species. In some groups, the exact structure of the volsellar plate appears to be specific but it is so difficult to make out and the shapes of the parts depend so much on the direction from which they are seen that it is probably better to rely on other characters.

The seventh and eighth (morphological eighth and ninth) sternites are fused



Figs. 76–88.

Fig. 76. Pronotum from left side, *M. collarellus* Rich. ♀.
77. The same, dorso-lateral view.
78. The same, *M. collaris* (Ducke) ♀.
79. Left proepisternum, ventral view, *M. collaris* (Ducke) ♀.
80. Antenna, with segment 13 more enlarged, *M. collaris* (Ducke) ♂.
81. The same, *M. collarellus* Rich. ♂.
82. The same, *M. superus* Rich. ♂.
83. Sternites 8 and 9, ventral view, *M. superus* Rich. ♂.
84. Genitalia, left side, *M. superus* Rich. ♂. (a) Paramere. (b) Parameral spine.
85. The same, right half in ventral view.
86. The same, basal ring in ventral view.
87. The same, aedeagus—(a) dorsal view, (b) from left.
88. The same, volsellar plate in ventral view. (a) Mesal ramus of digitus. (b) Digitus. (c) Cuspis.

into a single plate which is anteriorly tridentate and posteriorly broadly rounded. The central anterior process sends arms across the ventral surface which extend to the point where the eighth tergite is attached (fig. 83).

The basal ring is saddle-shaped ventrally, but membranous dorsally (fig. 86). The parameres are broad and are without setae except on the parameral spine. In ventral view (fig. 85) the inner margin is a little emarginate before the distal

extremity. In lateral view (fig. 84) the distal extremity is rounded. The two parameres are joined dorso-anteriorly by a small connecting piece which on the mid-line is produced ventrally (*i.e.*, on its inner side) into a strong keel. The parameral spine is long and pointed and in good specimens bears some bristles both externally and internally. It is articulated along the inner dorsal edge of the paramere by more than half its length. In ventral view, its distal part narrows rather suddenly. The volsellar plate (fig. 88) varies greatly in shape according to the view point. It consists of (*a*) a long narrow piece articulating with the paramere near the point where the two parameres meet = mesal ramus of digitus; (*b*) a recurved lobe on a shorter stalk attached to the mesal ramus = digitus; (*c*) a short curved narrow piece, closely attached to the sub-distal emargination of the inner ventral edge of the paramere = cuspis. It bears a number of fine bristles. The distal part of the digitus and of its stalk are usually soft and colourless. There are three areas of the volsellar plate which are more heavily sclerotised and bear black nodules, viz. (1) the anterior margin of the digitus (10–11 nodules in *M. superus*); (2) part of the stalk of the digitus near its attachment (11 nodules in *M. superus*); (3) the inner margin of the cuspis opposite the nodular part of the digitus (7 nodules in *M. superus*). All the rows of nodules are irregularly double.

The aedeagus (fig. 87) is sclerotised dorsally to form a spatha which ends angularly anteriorly. There are a pair of anterior apophyses. The posterior end of the aedeagus is rounded in dorsal, ventral and lateral views. In lateral view, there is a small ventral hook at the point where the apophyses meet the spatha and, in *M. superus*, there are twelve strong black hooks along the margin between the hook and the distal extremity, not extending to either. The number of these hooks varies specifically but it is difficult to count them.

M. collaris (Ducke) and *M. collarellus* Rich. have genitalia very similar to *M. superus* Rich.

Nest. The comb is characteristically triangular, *i.e.*, 1 cell with petiole, 2 cells, 3 cells, etc. The real rows of cells, however, are parallel with sides of the comb. The edge of the comb opposite to the petiole is usually more or less rounded, but according to Zikán (1935) in many combs of *M. collaris* var. *parallelogrammus* Zik. the number of cells in a section parallel to the petiole is reduced again so that the comb is a parallelogram or elongate hexagon, rather than a triangle. In all types the petiole is very eccentric.

Larva. Reid (1941 : 324–5, figs. 131–2) described the larvae of *M. collarellus* Rich. and *M. superus* Rich. Both have two ventral lobes with rounded ends on the first abdominal sternite. The lobes of *M. superus* are, however, much more divergent. The head with the genae is brown. The ventral surface bears bristles on the sternites as well as on the lobes, but in *M. collarellus* they are inconspicuous and more or less erect, whereas in *M. superus* they are coarse and conspicuous and directed backwards.

Mischocyttarus collaris (Ducke).

Megacanthopus collaris Ducke, 1904 : 361.

Colour-pattern described under the varieties.

♀. Surface of head and thorax with moderately dense short white pubescence; mandibles and clypeus with scattered reddish-bristles; legs and abdomen with dense appressed yellowish pubescence, petiole with moderately abundant outstanding pubescence at sides and beneath; sternite 5 with dense outstanding pubescence. Length (H. + Th. + T1 + T2) 10·0 mm.

Head dull with very close fine punctures. Mandibles shining, with rather numerous large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth.

Malar space at narrowest just obliterated. Width of clypeus at its narrowest about the same as its length, ventral third with more numerous large, bristle-bearing punctures, ventral margin not depressed, rather weakly triangularly produced over its whole width. Tentorial pits twice as near to eyes as to antennal sockets. Antennal segment 3 as long as or a little longer than 1. Antennal sockets almost twice as far from one another as from eyes. Eyes a little closer together ventrally than on vertex, in contact with clypeus for a considerable distance. Ocelli of moderate size, in an equilateral triangle, hind ocelli separated rather less than two diameters, POL : OOL = 1 : 2. Occiput not margined, its width behind eyes dorsally not quite twice distance between posterior ocelli; tempora half width of eye. Thorax + propodeum not quite twice as long as broad; mesonotum with very close fine punctures, rest of thorax and propodeum with still closer and finer punctures, almost granulate, dull. Pronotum with the anterior margin strongly raised and reflexed, the raised margin with three transparent depressions, margin ending hook-like below and not preceded by a furrow; no lateral fovea; keel very strong, convex anteriorly, extending to a point which is farther from where it would meet the posterior margin of the pronotum if it was produced to meet it than is the postero-dorsal angle of the pronotum. Anterior margin of proepisternum strongly raised, moderately reflexed, sides completely and strongly margined. Upper division of metapleuron subacutely produced along meso-metapleural suture. Tegulae nearly dull, not visibly punctured, margin almost regularly curved. Postscutellum strongly flattened, in profile forming a continuous curve with scutellum. Propodeum with central furrow weak and ill defined. Mid tibia with two nearly equal spurs. Mid tarsi with inner distal angle of segments 3 and 4 strongly produced. Hind tarsi with inner lobe of segment 3 much longer than outer lobe of 4 which is about half as long as its inner lobe, claws strongly asymmetrical. Abdominal petiole rather short, not as long as hind femur, sides diverging for its whole length, very slightly contracting before posterior margin, which is two and a half times as wide as anterior width, spiracular ratio 2 : 3, spiracles a little but quite obtusely projecting, ventrally the membranous emargination almost obsolete (*i.e.* posterior margin straight). Tergite 2 strongly expanded, about as long as broad.

♂. Resembles ♀ except in following particulars :—face below antennae with dense short silvery pubescence; mesopleuron and fore femur beneath also with more silvery pubescence; pubescence of abdominal petiole shorter; sides of sternites 5–6 and whole of 7 with outstanding pubescence. Length (H. + Th. + T1 + T2) 9·0 mm.

Mandibles almost unpunctured, with three distal teeth. Clypeus with ventral margin almost straight. Tentorial pits about five times as close to eyes as to antennal sockets. Antennal segment 3 considerably longer than 1 + 2 or than 4 + 5, 4 twice as long as broad, segments gradually decreasing in length to 12, which is a little longer than quadrate, 13 flattened, distally enlarged, the segment much curved, a little longer than 11 + 12, antennae distally spirally rolled, segments 3–8 with a ventral fringe of white pubescence. Eyes more approximated below, in contact with clypeus for a longer distance. Hind ocelli separated by rather less than one and a half diameters. Occiput one and a half times as wide as distance between posterior ocelli. Tempora one-third as wide as eye. Sculpture of mesopleuron rather finer. Fore tarsi very broad, segments 2–5 with dense white pubescence beneath, segment 5 short, subcordiform, not as long as twice distal width. Mid tibia with shorter spur half as long as other. Genitalia very similar to *M. superus* Rich. (p. 414) but digitus more pointed anteriorly and 14 teeth, rather short and indistinct, beneath the aedeagus.

Mischocyttarus collaris var. *collaris* (Ducke, 1904).

♀. Yellow; the following parts *black*—tip of mandibular teeth, area surrounding the ocelli emitting two rectangular areas which are connected antero-laterally with antennal sockets by small black projections, streak along occiput connected to inner angle of eye and to ocellar area, indefinite spot on pronotum in front and about half width of keel, stripe on

postero-dorsal lobes of pronotum, mesonotum except two broad yellow discal streaks, narrow anterior and posterior margins and central line on scutellum, narrow posterior margin of postscutellum, central streak on propodeum, dorsal keel of propodeal orifice, prepectal suture, hollow beneath base of fore-wing; the following parts ferruginous—antennae (except segment 1 beneath), transverse discal mark on scutellum, streak along lateral furrow of propodeum and another between it and central black streak, lower posterior margin of mesopleuron just above mid coxae, dorsal streak on mid and hind coxae, posterior and anterior streaks on all femora and fore tibiae, nearly all mid and hind tibiae, all tarsi (segments 3–5 of hind tarsi blacker), abdomen with tendency for posterior margin of segments to be yellower. Wings very slightly brown-tinged. Dorso-lateral margin of valve-plate of propodeum subacute. Length of fore-wing 10·5 mm.; hamuli 9.

♂. Resembles ♀ except :—tip of mandibles yellow, black marks in ocellar region somewhat more confluent; ferruginous markings little distinguished from ground-colour. Antennal segment 13 dorsally black, ventrally indefinitely black on distal half. Wings hyaline. Length of fore-wing 10·0 mm.; hamuli 9.

Specimens examined :—Brazil : Amazonas, Obidos, 1906, ♂, 19.xii.1907, ♀ (*A. Ducke*) (B.M.) [det. Ducke].

The type of this species, which was described from Belem do Pará, Obidos and Oyapoc, is probably in the Museu Goeldi. Ducke did not separate the present species from *M. collarellus* Rich., but the above specimens agree with his description.

Mischocyttarus collaris var. *parallelogrammus* Zikán.

Mischocyttarus parallelogrammus Zikán, 1935 : 172.

♀. Yellow with the following *black* markings which in some specimens are more or less replaced by *ferruginous*—mandibular teeth, more or less large central mark on clypeus reaching dorsal margin, dorsal part of head except broad inner orbits and two large spots above the antennae. Pronotum except all margin and the collar, mesonotum except two lines on mesonotum, scutellum except small spots at sides, large posterior mark on postscutellum, median streak, interrupted sublateral streaks of propodeum, H-like mark on mesopleuron (leaving spot at top of prepectus and lower posterior corner of mesopleuron yellow), metapleuron except top of upper division, abdomen except narrow posterior bands on tergites 1–4 and sternites 2–3. In some specimens the thoracic markings (except of mesonotum) and the whole of the legs and abdomen (or the black parts of the abdomen) are ferruginous. Mid coxa with one, hind with two dorsal streaks; anterior (and sometimes posterior) streak on fore femur, anterior and posterior streaks (sometimes both double) on mid and hind (in this case streaks largely confluent) femur, posterior streak on fore tibia, most of mid and hind tibia except distal fifth, last segment of mid tarsi, last three of hind tarsi. Structurally similar to var. *collaris*; sculpture of mesopleuron tending to be a little stronger; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 9·5–11·5, average 10·4 mm.; hamuli 8–12, average 9·0.

♂. Resembles the female in colour and differs from it in structure in the same way as the sexes of *M. collaris* Ducke differ, except :—antennae 13 less dilated, entirely pale beneath. Fore tarsi with segment 5 a little longer, twice as long as distal width; hind tarsi with segment 5 considerably longer than shorter edge of 3. Dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 10·5 mm.; hamuli 10.

Specimens examined :—Brazil : no precise locality, viii.–ix.1923, 2 ♀ [one with clypeus yellow] (*W. S. Bristowe*) (O.W.R.), Lagoinha, 23.vii.1923, 2 ♀ (*W. S. Bristowe*) (O.W.R.), Lagoinha, 23.vii.1923, nest and 6 ♀ (*H. B. Cott*) (B.M.), Rio de Janeiro, ♀ (F. Smith coll.) (B.M.), Barrereira, 2.iii.1914, ♀ (*Prof. Breslau*) (B.), Sta. Catharina, highlands, ♂ (*E. Ule*) (B.).

This form was described as a species by Zikán (1935 : 172); I believe I have correctly recognised it from the description both of the insect and of the nest. It appears to be a geographical representative in S.E. Brazil of *M. collaris* (Ducke) of the Amazons; more specimens of both forms could be examined with advantage. The slight differences apparent between the single male of each form which was available may not be significant.

The six females from one nest obtained by Dr. H. B. Cott show that extreme black and ferruginous forms may occur together.

Mischocyttarus collaris var. **melanopygus** var. n.

♀. Yellow; mandibular teeth and ventral margin of clypeus pitchy-red. Antennae black, segment 1 yellow beneath, 8–12 brownish beneath. Black marks as follows :—Small ventral spot and upper margin of supraclypeal plate, broad processes from ocellar spot (which is all black) to outer edge of sockets, moderately produced into eye-emargination, internally rectangularly emarginate just before socket, processes meeting at posterior limit of emargination and enclosing a pyriform yellow spot (twice as long as broad), lateral wings short, connection to black occipital mark broad; foraminal depression and linear area on occiput black, broadly connected to inner posterior corner of eye; pronotum with broad spot in front of keel one-third its width, and lateral stripes black. Mesonotum black with two central yellow stripes, not quite complete in front, separated by nearly twice their width; scutellum with anterior and posterior margins and central line narrowly black, and a broad transverse discal mark; postscutellum with posterior margin narrowly black. Propodeum with very narrow anterior margin, continuous central and lateral stripes, latter connected to squarish spots in depressions, margin of orifice, black; large spot in depression beneath fore-wing, dorsal mesopleural furrow, sending stripe just in front of meso-metapleural suture down to mid coxae, black; posterior half of mid coxae black, condyle yellow; dorsal half of hind coxae (except two short yellow stripes on the angles, black, condyles fuscous; mid and hind trochanters and femora black dorsally, their tibiae somewhat brownish centrally, their tarsi with segments 3–5 black; abdomen entirely black. Tegulae testaceous with anterior and posterior yellow spots. Wings very slightly infuscate. Length (H. + Th. + T1 + T2) 9·0–10·0 mm. Length of pronotal keel as in *M. collarellus* Rich.; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 10·0–11·0, average 10·5 mm.; hamuli 8–9, average 8·8.

Specimens examined :—Peru : Valle Chanchomayo, 800 m., 1.iv.1939, ♀ type (*Weyrauch*) (J.B.); paratypes, Col Perene, El Campamiento, 21.vi., ♀, 25.vi.1920, 2 ♀ (C.). Although the pronotal keel resembles that of *M. collarellus* Rich., the wing-length, sculpture and geographical distribution make it more natural to place this form under *M. collaris* (Ducke).

Ducke (1904 : 361), in describing the species from Amazonia and Brazilian Guiana, notes that the nest is very oblique with the petiole very eccentric. In (1905 : 687, pl. 4, fig. 21) he figures a nest which he says somewhat resembles that of *Polistes goeldii* Ducke. There appear to be two rows of large cells near the petiole, but much of the comb consists of a single row of cells, *i.e.* the triangular comb is much drawn out at the angle farthest from the petiole. There seem to be about 12 cells. In (1907 : 189) he adds that he has seen even more elongate nests than the one figured in (1905) and that this shape is characteristic for the species.

Bequaert (1933 : 119) records finding three small nests of *M. collaris* on a bush near Manáos, Brazil, Aug. 1924. " . . . when I attempted to take them, all the wasps flew away without attacking. The same bush, however, was settled by a large colony of the ant, *Dolichoderus* (*Hypoclinea*) *abruptus* (Smith)

(named by Dr. W. M. Wheeler), which had built brown paper covers over the undersides of most of the leaves. When the bush was disturbed, the ants became very angry, running over all the branches and biting furiously, whenever given a chance."

Zikán (1935 : 172–5, pl. 1, fig. 2) has described and figured the nest of the var. *parallelogrammus* Zik., of which he found many near Rio de Janeiro. They are usually attached to vertical rock-surfaces but the petiole is usually at an angle so that the comb comes to be horizontal. It is more symmetrical than that of any other species. The sides of the comb are flat and perpendicular to the ground (or nearly) and together form a parallelogram with the petiole in one corner. Other combs are more in the shape of a long hexagon, the central parts of the sides being parallel to one another. The cells are always very symmetrically arranged. The angle at the petiole is filled by one cell, then two, three, up to five or six, then narrowing again, till at the end there is one again. The middle or broadest part of the comb may have two or three rows in succession with the same number of cells.

The nests of the hexagonal type are somewhat different, for the rows of cells are at right angles to the sides of the comb instead of oblique. In such nests, the first and last cells are pentagonal, whereas in the other type they are quadrangular. The outer walls of the cells at the comb-margin are nearly flat instead of being convex as in other species. In completed nests, there is usually an extra comb fixed to the tip of the main one which rather spoils its symmetry. Cells may be used more than once for rearing, as can be seen from the remains of the old cocoon.

On a perpendicular rock, 3–4 m. up, in bushes at the edge of a road, were found 4 nests, 2 deserted. On the smaller one of 11 incomplete cells were 5 ♀, on the larger of 35 cells (one of each contained an empty cocoon) were 4 ♀. A very large nest was found in a hole in a large rock by a stream. The comb was 6 cm. long, 3½ cm. broad and consisted of 57 cells; 11 ♀ were present. Ten Phorid flies were bred from some of the cocoons. In this nest, also, some of the cells were being used a second time. A nest on a rock at the edge of a water-channel was studied from its inception. By mid-February the single queen had covered 5 cells (*i.e.* put carton on the cocoon-caps), of which two produced wasps about 20.ii. Others emerged as follows :—one 3.iii., one 5.iii., one 13.iii., one 18.iii. On 20.iv., when the comb was 2·7 × 1·8 cm. and consisted of 24 cells, the nest was taken, there being only three females present. All the cells were empty and this shows that the nest is deserted by individuals as they emerge and harden up, as has also been observed in *Polistes versicolor* (Oliv.). Only a few hardened specimens remain with those that are still soft to look after the nest.

I have examined one nest (pl. 3, fig. 180) of the var. *parallelogrammus*, no. 416, Brazil : Lagoinha, 23.vii.1923 (*H. B. Cott*) (B.M.). It is recorded that it was hanging from a rock-face. It is made of light grey-yellow carton, formed of rather large irregular wood-fragments, with a thick coating of pale varnish. The petiole is broken off. The cells are arranged as follows :— $\frac{6\text{ P., }5,\ 5,\ 4}{4\text{ P., }4,\ 4,\ 4,\ 3,\ 1} = 20$ cells. All the outer walls of the marginal cells are flat, except in one of margins farthest from the petiole where new cells are being added. The proximal surface of the comb is nearly flat but mammillated and the distal surface is also nearly flat. Probably seven cells adjoining the petiole had had cocoons and were being used again.

Mischocyttarus collarellus Richards, 1940 : 177.

♀. Yellow, the following markings *black*—tip of mandibles, distal half of antennal segment 1 above, the area surrounding the ocelli emitting both two rectangular areas in front which are narrowly joined to the antennal sockets and small projections at level of posterior ocelli, broad streak along top of occiput connected to inner angle of eye and to ocellar area, a small spot on pronotum in front of and one-third the width of the keel, stripe on postero-dorsal lobes of pronotum, mesonotum except two parallel discal and short lateral streaks, anterior and posterior margins and a central line on the scutellum, posterior third of postscutellum, propodeum with central, interrupted sublateral and lateral (incomplete anteriorly) streaks, hollow beneath base of fore-wing, streak along prepectal suture emitting another along meso-metapleural suture. The following markings *ferruginous*—most of antennae, indefinite streaks on mid and hind coxae, dorsal streaks on mid and hind femora, most of proximal four-fifths of mid and hind tibiae, abdomen except posterior margin of segments. Tegulae testaceous, yellower proximally. Wings distinctly fuscous. Surface of head and thorax with sparse, short, pale pubescence; mandibles and clypeus with short, scattered reddish bristles; legs and abdomen with dense, microscopic pubescence; abdominal petiole with rather sparse outstanding pubescence at sides and beneath; sternites with pubescence becoming outstanding posteriorly, that on 6 dense. Length (H. + Th. + T1 + T2) 10·5–11·0 mm.

Structurally very close to *M. collaris* (Ducke) :—average size a little larger, sculpture of mesopleuron a little finer, often hardly visible; keel of pronotum longer and therefore reaching back nearer to posterior margin, extending to a point which is nearer to where it would meet the posterior margin of the pronotum if it was produced to meet it than is the postero-dorsal angle of pronotum. Tegulae rather more shining. Larger claw of hind tarsi thicker and blunter. Dorso-lateral margin of valve-plate of propodeum acute (27 spec.) or subacute (3 spec.). Length of fore-wing 11·0–13·0, average 12·3 mm.; hamuli 9–12, average 10·6.

♂. Resembles ♀ in colour, but black markings tend to be a little reduced. Fore femur with a black anterior streak. Size a little smaller. Structurally resembles that of *M. collaris* (Ducke) :—antennal segment 13 a little less dilated, ventrally with distal quarter sharply black; flagellar fringe perhaps a little longer. Sculpture of thorax as in ♀. Dorso-lateral margin of valve-plate of propodeum subacute. Fore coxa and femur with short dense pubescence beneath; fore tarsi with segment 5 about twice as long as distal width; hind tarsi with segment 5 distinctly longer than shorter edge of 3. Length of fore-wing 10·5, 11·0, 11·5 mm.; hamuli 8. Genitalia very like those of *M. superus* Rich. (p. 414) but aedeagus with 14 very strong teeth beneath.

Specimens examined :—British Guiana : Mazaruni Settlement, second-growth forest, 22.ix.1937, 4 ♀, 3 ♂ including type ♀ and allotype ♂ (nest 295) (*Richards and Smart*) (B.M.), 18.ix.1937, 4 ♀ (nest 277) [paler variety, pronotal spot small, lateral and sublateral stripes on propodeum very widely interrupted], 22.ix.1937, 2 ♀ (nest 297), 24.ix.1937, ♀ (nest 318) [pale var., as above], 27.ix.1937, ♀ (nest 344) [intermediate between usual form and dark variety described below] (*Richards and Smart*) (B.M.); Cuyuni R., 3 miles from Kartabo, high forest, 20.ix.1937, 2 ♀ (nest 284), 3 ♀ (nest 285) (*Richards and Smart*) (B.M.); Potaro R., trail between Tukeit and Kaieteur, high forest, 1.ix.1937, ♀ (nest 141), 3.ix.1937, ♀ (nest 183) (*Richards and Smart*) (B.M.); Essequibo R., Moraballi Creek, high forest, 6.xi.1929, ♀ (*Oxford Univ. Exped.*) (B.M.). Panama : Trinidad Rio, 20.iii.1912, ♀ (*A. Busck*) (J.B.). Dutch Guiana : Paramaribo, 2 ♀ (*Heller*) (B.). Brazil : Guiana, Obidos, 15.v.1905, ♀ (*A. Ducke*) (B.) [det. as *M. collaris* by Ducke]; Amazonas, Manáos, Flores, 4.viii.1924, ♀ (D.E.I.).

Dark variety. A few specimens have a colour-pattern resembling that of *M. collaris* var. *parallelogrammus* Zik., except that the clypeus is yellow; the spot on the pronotum in front of the keel is broad and covers almost the whole width of the keel; the stripes on the propodeum are complete and the lateral and sublateral ones are joined by a ferruginous suffusion; the mesopleuron bears an H-shaped black mark.

Specimens examined:—British Guiana: Mazaruni Settlement, second-growth forest, 25.ix., 2 ♀ (nest 325), 27.ix.1937, 2 ♀ (nest 348) (*Richards and Smart*) (B.M.); Essequibo R., Moraballi Creek, high forest, 11.viii.1939, ♀ (nest 227) (*Oxford Univ. Exped.*) (B.M.).

The larva is described on p. 416.

Twelve nests (pl. 3, figs. 170–9) of *M. collarellus* Rich. have been examined. British Guiana: Mazaruni Settlement, second-growth forest, 1937, no. 295, upperside palm-leaf 7 ft. from ground, 22.ix.; no. 277, upperside palm-leaf 6 ft. from ground, 18.ix.; no. 325, underside mid-rib leaf of small tree, 25.ix.; no. 348, on dead liane hanging vertically down, 27.ix.; no. 297, underside leaf palm 2 ft. from ground, 22.ix.; no. 318, upperside leaf small tree (not on mid-rib), 24.ix.; no. 344, underside leaf small spiny palm 3 ft. from ground, 27.ix. R. Cuyani, Kamaria Landing, 20.ix.1937, nos. 284–5, upperside leaves of small tree 7 ft. from ground. Potaro R., Tukeit–Kaieteur trail, no. 141, underside leaf of *Bromelia karatas* 3 ft. from ground, 1.ix.1937; no. 183, underside leaf *Bromelia karatas*, 3.ix.1937. Essequibo R., Moraballi Creek, no. 227, 11.viii.1929.

Of the eleven nests of which the site is recorded, 5 were beneath leaves, 5 on the upperside of leaves and one on a vertical stem. In the allied *M. superus* all nine nests for which the site was recorded were on the upperside of leaves.

No. 295 is a reddish-brown nest with carton made of moderately large often rather irregular wood-fragments, moderately shining, rather heavily varnished. The petiole is heavily varnished, 7·0 × 2·0 × 1·0 mm., flattened at right angles to the long axis of the nest, attachment-plate 4·0 × 3·0 mm., buttresses slight, cone of attachment large. There are two rows eleven cells, the petiole being attached to an end cell and the smallest cells being farthest from it. This makes a nest very like that of *M. collaris* figured by Ducke (p. 419) which may indeed have belonged to the present species. Starting from the petiole, the first four cells are being used again, the next eight are pupae. The external sides of the cells are flat, as in *M. collaris*. The completed cells are 15·0 × 4·3 mm. The cocoon cap is of brown semi-transparent silk built originally about 0·5 mm. below the level of the cell-top, but plastered over with carton, probably cut from the distal edge of the cell. The eggs are attached on the side of the cell farthest from the petiole 2·0 mm. from the bottom.

No. 141 is a similar nest of 18 cells, but the petiole is 6·0 × 3·0 × 1·0 mm., broadening and flattening out into considerable buttresses on the attachment-plate, which is 7·0 × 3·0 mm. The flattening is at right angles to the long axis of the nest. In smaller nests, the petiole is usually less flattened. No. 227 has two rows of 10 and 9 cells. The first four are being used again and the next four are cocoons.

In Table 6 is found a summary of the combs and their contents.

It seems certain from Table 6 that while some colonies are founded by one queen (344, 318, possibly 141), others (277, 183, 325) are founded by two or three wasps. In this case, there seems to be a greater tendency for a number of small cells to be built in quick succession. The very asymmetrical shape of

the nest may, perhaps, limit its size and lead to old cells being used again before the comb is very large.

TABLE 6.

Nests of *M. collarellus* Rich.

Nest no.	Cells	Wasps present	Eggs	Larvae	Pupae	Empty cells	Remarks
295	11 P., 11 = 22	2 ♀	5	12	5	0	4 cells being used again.
141	7 P., 7, 4 = 18	1 ♀	8	7	2	1	
277	7 P., 7 = 14	3 ♀	9	3	1	1	Empty cell = empty cocoon.
183	7 P., 6 = 13	1 ♀, 1 lost	12	0	0	1	No cell longer than 4 mm.
297	8 cells	No wasp	4	2	2	0	Two females emerged later.
325	4 P., 3 = 7	2 ♀	6	0	0	1	All cells small.
285	3 P., 3 = 6	1 ♀	1	2	2	1	
348	3 P., 3 = 6	2 ♀	2	2	1	1	
284	5 small cells	3 ♀, 1 lost	5	0	0	0	
318	4 small cells	1 ♀	3	0	0	1	
344	3 small cells	1 ♀	3	0	0	0	

Mischocyttarus superus Richards, 1940 : 178.

♀. Yellow, the following markings *black*—tip and dorsal edge of mandibles, dorsal side of antennae and most of segments 2–12 beneath, areas round ocelli and on occiput (as in *M. collarellus* Rich.), spot on pronotum in front of and one-quarter to one-half as wide as the keel, stripe on postero-dorsal lobes of pronotum (often very reduced), mesonotum except two parallel discal streaks and usually two postero-lateral, short stripes, anterior and posterior margins and central line on the scutellum, very narrow posterior margin of post-scutellum, propodeum with central and lateral streaks (latter, more rarely both, evanescent anteriorly), sublateral streak indicated by a black posterior spot, usually at least a minute spot in hollow beneath base of fore-wings, fifth segment of hind tarsi dorsally (except one spec.), abdominal tergite 1 except narrow anterior and lateral margins and posterior sixth, abdominal tergites 2–4 except very narrow posterior margins, tergites 5–6, round spots at sides of sternites 5 or 4–5, sternite 6 except sometimes a central yellow spot. The following markings are *ferruginous* in darker specimens tending to *black*—antennal segments 3 and 9–12 (or more) beneath, feeble streaks on mid coxa above and mid femora behind, streaks on hind coxa dorsally, hind femora dorso-posteriorly, hind tibiae dorsally. Wings distinctly fuscous. Surface of head and thorax with sparse, short, pale pubescence; mandibles and clypeus with short, scattered, reddish bristles; legs and abdomen with microscopic pubescence which on abdomen is less dense than in *M. collarellus* Rich., so that this part is more shining; abdominal petiole at sides and beneath with sparse outstanding pubescence, sternites with outstanding pubescence, that on 5–6 dense. Length (H. + Th. + T1 + T2) 9·0–10·0 mm.

Structurally close to *M. collaris* (Ducke) and *M. collarellus* Rich., but differing as follows :—thorax, especially mesopleuron, less closely punctured, with very narrow slightly shining interspaces visible on pleuron; keel of pronotum as in *M. collarellus* Rich.; tegulae more shining; central furrow of propodeum even more obsolete; dorso-lateral margin of valve-plate of propodeum subacute (12 spec.) or obtuse (13 spec.); segment 5 of hind tarsi longer than 2; claws as in *M. collarellus* Rich.; length of fore-wing 8·5–11·0, average 10·6 mm.; hamuli 7–10, average 8·5.

♂. Resembles the ♀, except in the following particulars :—tip of mandibles yellow, black markings of thorax and legs often more reduced. Antennae black, segment 1 ferruginous beneath, 6–13 whitish beneath with distal third of 13 sharply black. Fore femur with a black anterior streak. Mid coxa yellow, mid femora with a black streak in front, yellow behind. Last segment of hind tarsi only distally black. Face below the antennae and to a less extent the mesopleuron and sternum with silvery white pubescence. Outstanding

pubescence of posterior abdominal sternites less distinct. Length (H. + Th. + T1 + T2) 8·0 mm.

Mandibles less punctured, with three distal teeth. Clypeus with ventral margin straighter. Tentorial pits almost touching eyes, as far from antennal sockets as latter are from one another. Antennal segment 3 considerably longer than 1 + 2 or 4 + 5, 4 twice as long as broad, segments gradually decreasing in length to 11, which is one and a half times as long as broad, 12 a little longer, 13 not quite as long as 11 + 12, strongly dilated distally, anterior margin straight, posterior curved, antennae distally spirally rolled, segments 5–10 flattened beneath but hardly perceptibly ciliate. Eyes more approximated below, longer in contact with clypeus. Mesopleuron duller, sculpture finer. Fore femora with a very short, dense, ventral fringe of white pubescence; fore tarsi less broad than in allied species, not pubescent beneath, segment 5 about twice as long as distal width. Mid tibiae with shorter spur at least half as long as longer spur. Dorso-lateral margin of valve-plate of propodeum subacute (1 spec.) or obtuse (3 spec.). Length of fore-wing 9·0–9·5, average 9·25 mm.; hamuli 7–9, average 8·0. Genitalia described on p. 414, figs. 84–8.

Specimens examined :—Mazaruni Settlement, second-growth forest, 22.ix., 2 ♀ (including type) (nest 296), 14.ix., 2 ♂, 3 ♀ (including allotype) (nest 260), 14.viii., 5 ♀ (nests 16, 17 and 51), 21.viii., 2 ♀, 2 ♂ (nest 70), 25.viii., 3 ♀ (nest 107), 29.viii.1937, ♀ (nest 134) (*Richards and Smart*) (B.M.), in colony house, 21.viii.1937, ♀ (*Richards and Smart*) (B.M.); Kartabo district, x.1920, 5 ♀ (C.); Bartica–Potaro Rd., 50–100 miles from Bartica, 30.viii.1937, 2 ♀ (nest 150) (*Richards and Smart*) (B.M.); Potaro R., trail between Tukeit and Kaieteur, 6.ix.1937, ♀ (nest 220) (*Richards and Smart*) (B.M.).

The larva is described on p. 416.

Ten nests (pl. 4, figs. 186–94) have been studied. British Guiana: Mazaruni Settlement, second-growth forest, 1937, upperside leaf of small tree, no. 260, 14.ix.; no. 107, 25.viii.; no. 16, 14.viii.; no. 70, 21.viii.,; no. 296. 22.ix.; no. 134, 29.viii.; no. 17, 14.viii.; no. 51, 19.viii. Bartica–Potaro Rd., no. 150, upperside leaf small tree, 30.viii. Potaro R., Tukeit–Kaieteur trail, no. 220, upperside leaf of small tree, 6.ix.

None of the nests was attached at the mid-rib of the leaf and all were on the upperside; unlike *M. collarellus* Rich. in which half the nests are attached beneath leaves. All the nests are rather dark brown in colour. No. 260 has carton made of small, mostly elongate fragments, moderately shining, thickly covered with dark varnish. The petiole is 4·0 × 1·75 × 0·5 mm., flattened obliquely to the main rows of cells, but in a plane bisecting the nest. The attachment-plate is dark, 5·0 × 6·0 mm. There are no buttresses and the cone of attachment is moderate. The cells are as follows :—$\frac{5\text{ P., }5, 6, 5, 4, 2}{3, 6\text{ P., }6, 5, 4, 3} = 27$ cells. The proximal surface of the comb is fairly flat and forms an almost direct prolongation of the petiole. The distal surface is also fairly flat. The comb grows mainly on the arc of a circle, at points farthest from the petiole, so that the comb is subtriangular with two sides nearly straight and the third curved. The external side of the outer cells is not or hardly flattened. Completed cells are 16·0 × 3·3 mm. The cocoon-caps are of brown semi-transparent silk, usually pasted over with bits of carton. The eggs are laid on the side of the cell *nearest* to the petiole.

Table 7 gives a summary of the nests and of their contents.

It is clear from Table 7 that while colonies are often founded by a single female, she may (nos. 296, 70) be joined by at least one worker. Where more than one female is present (no. 70) it is sometimes possible for cell-construction to get ahead of oviposition, but normally they keep in step.

In nests 16, 70, 107 and 260, the females (apart from some emerging later from cocoons) were dissected and classified into queens and workers on the condition of the ovaries, which was sharply discontinuous. There are thus

Table 7.

Nest no.	Cells	Wasps present	Eggs	Larvae	Pupae	Empty cells	Remarks
260	5 P., 5, 6, 5, 4, 2 = 27	1 ♀ (4 ripe eggs), 2 ☿, 2 ♂	7	5	1	14	See description.
107	5P., 5, 5, 4, 4, 2 = 25	1 ♀ (5 ripe eggs), 1 ☿	9	1	1	14	
16	5 P., 5, 5, 4 = 19	1 ♀ (5 ripe eggs), 1 ☿ [1]	9	7	3	0	Comb irregular; 8 cells cocoons or recently vacated; remainder all very small cells.
70	17 cells	1 ♀ (2 ripe eggs), 1 ☿ [2]	7	2	0	8	
150	14 cells	2 ♀	6	4	4	0	Pupae in 4 cells next petiole.
220	11 cells	1 ♀	3	4	3	1	
296	11 cells	2 ♀	5	6	0	0	No cell complete.
134	10 cells	1 ♀	4	6	0	0	
17	6 cells	1 ♀ (2 ripe eggs)	2	3	0	1	
51	2 cells	1 ♀	0	0	0	2	

[1] This ☿ had one larger, but not ripe egg.
[2] This ☿ had ovaries of an intermediate type with rudimentary but no nearly ripe eggs. The fat body was enormous. Ordinary workers have the eggs so rudimentary as to be hardly recognisable. It is possible but very unlikely that these two specimens are freshly emerged females.

5 queens to compare with 5 workers. I can detect no external differences between them other than the slight average ones shown below.

	Hamuli			Length of fore-wing					Valve-plate	
Type of wasp	7.	8.	9.	10.	8·5.	10·0.	10·5.	11·0.	Obtuse	Subacute
Queen . .	1	1	2	1	0	0	2	3	2	3
Worker . .	3	2	0	0	0	0	1	4	0	5
Undissected ♀ .	1	4	6	4	1	3	6	5	6	9

Compared with *M. lecointei* (Ducke) (p. 411), the ♀ and ☿ have the same wing-length (not ♀ longer), but the ☿ has fewer not more hamuli. Only further studies can show whether the differences are significant.

Group of *M. prominulus* Rich. (text-figs. 89–92).

Characters of the adults given in the key (p. 309). The male genitalia have been examined in both *M. prominulus* Rich. (fig. 92) and *M. bequaertii* sp. n. The parameral spine bears numerous long bristles about the middle. The membranous lobe of the digitus is broad, not finger-shaped. There are 12 teeth beneath the aedeagus; the most anterior teeth become indistinct.

Nest. In *M. prominulus* there is a subcircular comb attached obliquely to an eccentric petiole which is a little flattened.

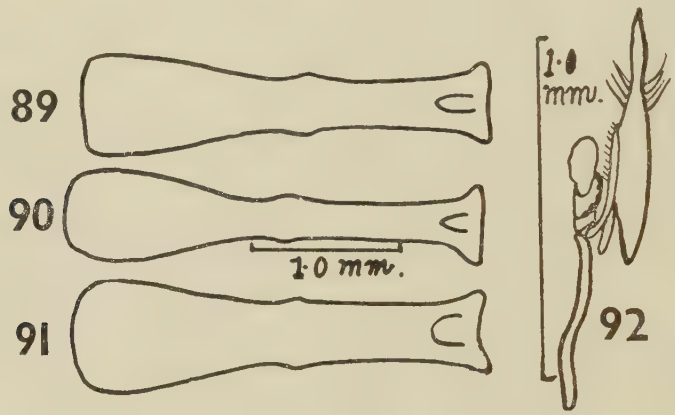
Larva. Not seen.

Mischocyttarus prominulus Richards, 1941 : 129.

♀. *Yellow*; antennae *ferruginous* except segment 1 beneath; antennal segments 1–2 above, disc of vertex, stripes on dorsal lobes of pronotum, discal stripe on mesonotum, dorsal stripes on mid and hind coxae, centre of abdominal tergite 1, whole of tergites 2–6 except posterior margins of 2–3, *somewhat darker*; narrow rings round ocelli, centre of occiput, central furrow of propodeum, last three segments of hind tarsi, *blackish*. Tegulae yellow, with hyaline external spot. Wings hyaline, costal cell hardly yellower, pterostigma yellow, venation brown. Head and dorsal surface of thorax and propodeum with rather sparse semi-erect pale pubescence, that on ventral half of clypeus longer and erect,

thoracic pleura with shorter more appressed pubescence; legs, first abdominal tergite and all sternites, with appressed pale microscopic pubescence, tibiae and tarsi also with reddish bristles; tergites 2–6 with very short appressed blackish pubescence; first abdominal sternite with moderately close, outstanding pale pubescence, that on sternites 2–4 somewhat shorter and sparser, that on 5–6 long and dense. Length (H. + Th. + T1 + T2) 7·5 mm.

Head almost dull, imperceptibly sculptured except vertex which is somewhat swollen and centrally impressed, the swellings on each side being finely and rather closely punctured; ventral half of clypeus with few large punctures. Mandibles shining, not punctured, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest hardly one-quarter as long as width of antennal socket. Width of clypeus where eyes approach most closely three-quarters its length, ventral margin not depressed, angularly but not very strongly produced over its whole width. Tentorial pits three times as far from antennal sockets as from eyes, separated from latter by only two or three diameters.



Figs. 89–92.

Fig. 89. Dorsal view of abdominal tergite 1, *M. prominulus* Rich. ♀.
90. The same, *M. prominulus* var. *tenuis* var. n. ♀.
91. The same, *M. bequaertii* sp. n. ♀.
92. Volsellar plate and parameral spine in ventral view, *M. prominulus* Rich. ♂.

Antennal sockets not quite twice as far from one another as from eyes. Antennal segment 3 as long as 1. Eyes separated ventrally by two-thirds as much as dorsally, in contact with clypeus for a long stretch. Ocelli in an equilateral triangle, separated from one another by a little more than diameter of one, POL : OOL = nearly 1 : 2. Occiput weakly margined in centre, its width behind eyes dorsally about twice POL. Tempora one-third width of eye. Thorax + propodeum a little more than twice as long as broad, dull (propodeum more shining), hardly perceptibly sculptured (under highest power finely puncto-granulate). Pronotum with anterior margin strongly raised and reflexed, preceded by a furrow of which posterior edge is obtuse; no lateral fovea; keel continuous, rather strong but not stronger at sides, straight. Proepisternum with anterior margin strongly raised and reflexed, sides feebly margined. Upper division of metapleuron not produced along meso-metapleural suture. Tegulae shining, unpunctured, margin almost a regular curve. Postscutellum strongly flattened, its anterior margin in same plane as scutellum. Propodeum with no anterior horizontal region, central furrow weak, dorso-lateral margin of valve-plate acute. Mid tibia with two spurs of equal length. Mid tarsi with segment 3 strongly asymmetrical, segment 4 strongly produced. Hind tarsi with inner lobe of segment 3 much more strongly produced than outer lobe of 4, the outer edge of which is half as long as its inner edge; segment 5 as long as 2, claws rather strongly asymmetrical, but larger claw not very

blunt. Length of fore-wing 7·0, 8·0 mm.; hamuli 6, 8. Abdominal petiole as long as hind femur, sides parallel to spiracles, then expanding a little but becoming parallel again, posterior hardly twice as wide as anterior margin, spiracular ratio 3 : 4, spiracles moderately projecting, membranous emargination of sternite about three times as wide as deep. Tergite 2 moderately expanded, a little longer than broad.

♂. Yellow; supraclypeal plate and transverse mark just above antennae and extending into eye-emargination, antennal segment 1 (except mesal and lateral yellow stripes), segment 2 dorsally, transverse, laterally expanded stripe on occiput, narrow rings round each ocellus, small anterior spot on dorsal lobes of pronotum, three ill-defined stripes on mesonotum, posterior half of scutellum, central furrow and latero-ventral depressions of propodeum, segments 2–4 of mid and hind tarsi, *brown* to *black*; abdomen browner, posterior margin of tergites 1–2 somewhat paler. Tegulae, wings and pubescence as in female, but pubescence of face shorter, silvery. Length (H. + Th. + T1 + T2) 7·5 mm.

Structurally resembles ♀ except in following particulars :—mandibles with only three distal teeth; clypeus about as long as broad, ventral margin more rounded; tentorial pits even closer to eyes and farther from antennal sockets; antennae with segment 3 as long as 1 + 2, considerably longer than 4 + 5, 4–10 becoming gradually shorter and thicker, 4 one and a half times as long as broad, 10 just transverse, 11 and 12 a little longer and thinner than 10 (12 just longer than broad), 13 two and a half times as long as broad, a little longer than 5, antennae subspirally rolled, no segment shining or ciliate; dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 7·0 mm.; hamuli 7; sternites with posterior margins not reflexed, 7 flattened with dense short pubescence. Genitalia (fig. 92) described on p. 425.

Specimens examined :—British Guiana : Mazaruni R., Kartabo, vii.1922, ♀ type (*M. D. Haviland*) (B.M.), Mazaruni Settlement, second-growth forest, 21.viii.1937, ♂ allotype (nest 75) (*Richards and Smart*) (B.M.). East Bolivia : 1.iii.1907, ♀ (*Steinbach*) (B.) [dark markings reduced, almost no rings round ocelli, hind tarsi pale].

Mischocyttarus prominulus var. **tenuis** var. n.

♀. Pale yellow; occipital margin and central furrow of propodeum black; antennae orange, darker dorsally; spot in front of pronotal keel, stripes on dorsal lobes, central stripe on mesonotum, dorsal stripes on mid and hind coxae and femora, central half of abdominal tergite 1, anterior three-quarters of tergites 2–5, *pale ferruginous brown*. Tegulae yellow with an outer hyaline spot. Wings hyaline, costa yellowish. Length (H. + Th. + T1 + T2) 7·5 mm.

Pubescence and structure as in typical form, except :—abdominal petiole with somewhat longer and denser outstanding pubescence, petiole longer (as long as hind femur + trochanter), narrower, spiracular ratio 2 : 3; dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 8·0 mm.; hamuli 7.

Type, Peru : Dept. Cuzco, 1900, ♀ (*Garlepp*) (B.).

One nest (Plate 1, fig. 133) has been examined, no. 75, Mazaruni Settlement, second-growth forest, 21.viii.1937, underside leaf of small tree 8 ft. from ground, attached to mid-rib. The carton is light yellowish-grey, made of moderate-sized, mostly oval fragments, a little shining with a moderate amount of varnish. The petiole is 2·5 × 1·0 × 0·5 mm., flattened parallel to the mid-rib of the leaf along which there are moderate buttresses. The attachment-plate is 3·0 × 2·0 mm. The comb consists of $\frac{3,\ 4\ \text{P.},\ 3,\ 2}{2\ \text{P.},\ 3,\ 4,\ 3} = 12$ cells, the smaller ones away from the petiole. It is irregularly circular with the proximal surface nearly flat and a little oblique to the petiole, distal surface irregular. Completed cells are

8·0 × 2·5 mm. The cells were all empty and had been used though there was no trace of cocoons and a single ♂ was seated on the nest.

Mischocyttarus bequaertii sp. n.

♀. Yellow; mandibular teeth and ventral margin of clypeus *reddish*; antennal segments 1–2 dorsally (3–12 orange to orange-brown), ocellar mark sending two anteriorly narrowing processes nearly to antennal sockets, mark enclosing an elongate yellow spot between ocelli, large, transverse, occipital mark (extending nearly half-way along back of tempora) narrowly joined to ocellar mark, broadly to posterior orbit, *black*; pronotum with transverse spot in front of keel and stripes on posterior lobes, *black*; mesonotum black with four yellow stripes (separated by rather more than their width); scutellum with narrow anterior border and triangular posterior mark, black; postscutellum narrowly black posteriorly; propodeum with complete central and lateral stripes narrow, joined along anterior and posterior margins (the lateral stripes really due to elongation of the antero-lateral triangles, very small spot in bottom beneath root of fore-wing, prepectal and dorsal furrows of mesopleuron, meso-metapleural suture, *black*; inner dorsal stripe of mid coxa black, condyle yellow-fuscous, most of trochanter, dorsal mark on proximal half of femur and proximal two-thirds of tibia, last three segments of tarsi, dark brown; central dorsal stripe on hind coxa, most of its condyle black, trochanter, proximal dorsal two-thirds of femur and tibia, last two segments of tarsi, brown; abdominal tergite 1 with central two-thirds, tergites 2–5 with anterior three-quarters brown, sternites yellow. Tegulae testaceous with anterior and posterior yellow spots. Wings hyaline, hardly yellowish costally. Length (H. + Th. + T1 + T2) 7·5 mm.

Pubescence and structure as in *M. prominulus* Rich., except in the following particulars :—outstanding pubescence on sternite 1 sparser; vertex less swollen, central impression less evident; malar space very little longer; width of clypeus where eyes approach most closely about equal to its length, ventrally a little more produced; eyes in contact with clypeus for less distance; occiput a little broader behind eyes, about two and a half times as wide as POL; tempora one-half width of eye; anterior margin of proepisternum raised, but very much less reflexed; upper division of metapleuron somewhat more produced along meso-metapleural suture; length of fore-wing 9·0 mm.; hamuli 8; abdominal petiole somewhat broader throughout, sides more regularly divergent, spiracular ratio 2 : 3.

♂. Resembles ♀ in colour, except :—anterior processes of black ocellar mark joined anteriorly between ocelli and omitting lateral process directed towards anterior part of eye-emargination; mesopleuron with small, dark, ventral spot; mid and hind coxae with condyles black with yellow spot. Length (H. + Th. + T1 + T2) 7·5 mm.

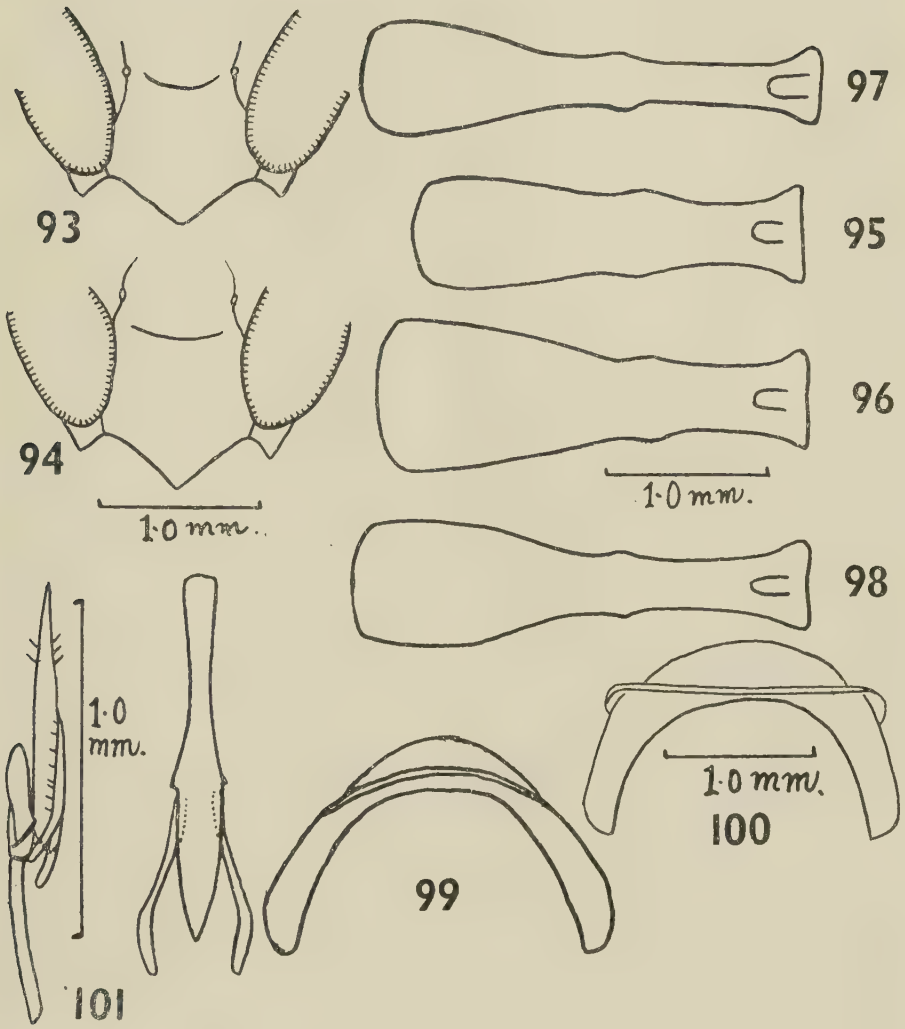
Structurally resembles ♀ except in features which separate the sexes of *M. prominulus* Rich., but :—clypeus a fraction broader, ventral margin more rounded; antennae with segment 3 considerably longer than 1 + 2, as long as 3 + 4 + ⅔ 5, 4–8 becoming gradually shorter and a little thicker, 4 nearly twice, 8 once as long as broad, 9–13 increasing in length and becoming thinner, 11–12 fully twice, 13 nearly three times as long as broad, as long as 6, antennae subspirally rolled; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 9·0 mm.; hamuli 7. Genitalia resemble those of *M. prominulus* Rich. (p. 425) but the membranous lobe of the digitus is a little longer.

Type ♂, allotype ♀, COLOMBIA : Dept. Meta, Restrepo, 500 m., 1936 (*J. Bequaert*) (J.B.).

The female, apart from colour, is only just distinguishable from *M. prominulus* Rich., but the male antennae are very different.

Group of *M. surinamensis* (Sauss.) (text-figs. 93–101).

The characters of the adults are described in the key (p. 309). The male genitalia have been examined in *M. sylvestris* sp. n. (fig. 101), *M. garbei* Zik.,



Figs. 93–101.

Fig. 93. Part of head with clypeus, *M. cleomenes* sp. n. ♀.
94. The same, *M. surinamensis* (Sauss.) ♀.
95. Dorsal view of abdominal tergite 1, *M. cleomenes* sp. n. ♀.
96. The same, *M. confusus* Zik. ♀.
97. The same, *M. surinamensis* (Sauss). ♀.
98. The same, *M. garbei* Zik. ♀.
99. Pronotum in dorsal view, *M. sylvestris* sp. n. ♀.
100. The same, *M. surinamensis* (Sauss.) ♀.
101. Aedeagus in dorsal view and volsellar plate and parameral spine in ventral view, *M. sylvestris* sp. n. ♂.

M. surinamensis (Sauss.) and *M. cleomenes* sp. n. The specific differences are slight and very indefinite. The parameral spine is long and bears only a few bristles. The membranous lobe is long and broad, ending distinctly before the end of the parameres (*M. sylvestris*) or almost as long as the parameres (the other species). The teeth beneath the aedeagus are 10–13, very small and difficult to count. The spatha is produced anteriorly into a long point almost reaching the junction of the parameres.

Nest. The petiole is usually but not always eccentric and a little flattened. The carton often seems to be very pale and the comb tends to be conical with its distal surface sub-circular. Eggs are laid on the sides of the cells about 3·0 mm. from the bottom.

Larva. Reid (1941 : 325, fig. 127) has described the larvae of *M. surinamensis* (Sauss.) and of " Species 10 " (see below). They agree in having two parallel ventral lobes on the first abdominal sternite. Conspicuous backward-directed bristles are present on most abdominal sternites. The genae have conspicuous colourless areas. The two species differ in that *M. surinamensis* larva has no brown anterior border to the labrum, the ventral lobes are pointed (not blunt) and the ventral bristles are on sternites 2–8 (not on 4–9).

" Species 10 " is available as a single immature specimen extracted from a cocoon. Its colour pattern is very similar to that of the typical variety of *M. surinamensis* (Sauss.) but the abdominal petiole seems to be more like that of *M. garbei* Zik. The nest (pl. 2, figs. 153–4), no. 321, British Guiana : Mazaruni Settlement, second-growth forest, 25.ix.1937, underside mid-rib of leaf of *Cordia nodosa*, 15 ft. from ground, is unique in the genus. Normally no *Mischocyttarus* comb has an external envelope distinct from the outer walls of the cells, whereas nearly all other Polybiinae (except a few which nest in hollow trees and other enclosed spaces) surround the comb with a complete envelope in which there is only a small entrance and exit hole. In " Species 10 " there is a symmetrical conical envelope like an umbrella over the whole comb, but the distal surface is completely exposed. The outer walls of the external cells are in many places distinctly separated from the envelope.

The nest is dark brown with a few pale patches, made of small mostly oval with some elongate wood-fragments. There is a moderate amount of varnish except on the petiole. The petiole is 1·0 × 1·5 × 0·5 mm., *i.e.* very short and flattened along the mid-rib. The attachment plate is saddle-shaped, 4·0 mm. long and there is no cone of attachment. The petiole is attached to the apex of the regularly conical envelope. The comb is composed as follows :— $\frac{5, 6\ (1\ C.), 7\ (?\ P.), 7, 7, 6, 4, 3}{5, 5, 7, 8\ (?\ P.), 7, 6, 4\ (1\ C.), 3} = 45$ cells. The exact place of attachment is difficult to make out owing to the envelope. The completed cells are about 14·0 × 3·5 mm. One or more adult wasps escaped when the nest was taken; 5 eggs, 2 larvae and 1 cocoon were present. The cocoon-cap is attached about flush with the distal end of the cell and is made of brown fibrous silk with strips of carton plastered on. The larva is described above.

Mischocyttarus sylvestris sp. n.

♀. Pale yellow; mandibular teeth and ventral margin of clypeus pitchy red; antennae black except ventral sides of segment 1 and 8–12, which are brown; ocellar mark black, very broadly produced forwards, only a narrow yellow line separating produced parts which extend to antennal sockets where each sends a small process inwards to form a short line between antennae, outer angle of produced piece extending some way into eye-emargination, yellow spot between ocelli very small, lateral wings large, quite or nearly extending to

corner of eye, occipital mark large, not enclosing a yellow spot, extending nearly half-way to mandibles; pronotum with transverse mark in front of whole width of keel and broad stripes on dorsal lobes black; mesonotum black, median stripes separated by fully twice their width, lateral stripes much abbreviated in front, situated well *within* lateral margin; scutellum with narrow anterior and posterior margins and a transverse discal cloud of which anterior edge is nearly straight, black; postscutellum with posterior third black; propodeum with central stripe and depressions above valve-plates black, antero-lateral triangles brown; hollow beneath root of fore-wing, ventral angle of prepectus, dorsal furrow of mesopleuron, more or less distinct mark at ventral margin of mesopleuron, centre of meso-metapleural suture, indefinite posterior patch on metasternum black or dark brown; inner side of mid coxa, dorsal side of trochanter, proximal dorsal two-thirds of femur brown; outer and central dorsal stripe on hind coxa, dorsal side of trochanter and femur, proximal dorsal four-fifths of tibia, tarsal segment 5 brown; dorsal side of abdomen nearly black, tergites 1–3 with very narrow posterior yellow bands, sternites yellow, 6 more or less darkened. Tegulae brown, posteriorly yellow. Wings hyaline, costal margin a little yellowish. Head and thorax with rather short, not very dense, outstanding pale pubescence, that on ventral half of clypeus longer; legs and abdomen with appressed pubescence (darker on abdomen), bristles on tibiae and tarsi very weak, abdominal petiole with long, moderately dense, outstanding pubescence, including some dorsally, sternites 2–6 with short outstanding pubescence, becoming dense on 6. Length (H. + Th. + T1 + T2) 9·0 mm.

Head dull, granulate, ventral third of clypeus with a few large punctures. Mandibles shining, with sparse large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest about one-quarter width of antennal socket. Width of clypeus where eyes approach most closely about equal to length, ventral quarter somewhat depressed and shining, margin moderately produced over central two-thirds, tip of produced part narrowly and weakly bidentate. Tentorial pits twice as far from antennal sockets as from eyes, well removed from both. Antennal sockets not quite twice as far from one another as from eyes. Antennal segment 3 not quite as long as 1. Eyes separated ventrally by three-quarters as much as dorsally, in contact with clypeus for a long stretch. Ocelli in an equilateral triangle, separated from one another by a little less than diameter of one, POL : OOL = 1 : 2·5. Occiput not margined, its width behind eyes dorsally nearly three times POL. Tempora between one-third and one-half width of eye. Thorax + propodeum about twice as long as broad, dull and granulate, separate punctures hardly perceptible. Pronotum with anterior margin little raised, preceded by furrow of which posterior margin is obtuse, though quite well raised; no lateral fovea; keel sharp-edged but little raised, dying away gradually laterally, in dorsal view straight. Proepisternum with anterior margin hardly raised, not reflexed, sides not margined. Upper division of metapleuron obtusely produced along meso-metapleural suture. Tegulae shining on outer half, lateral margin regularly curved. Postscutellum strongly flattened, in about same plane as scutellum. Propodeum with no anterior horizontal region, central furrow weak, extending to within one-fourth its length from postscutellum, central keel hardly indicated, valve-plate with dorso-lateral margin obtuse (1 spec.) or subacute (2 spec.). Mid tibia with two long spurs. Mid tarsi with segment 3 strongly asymmetrical, 4 strongly produced. Hind tarsi with inner lobe of segment 3 much more strongly produced than outer lobe of segment 4, the outer edge of which is two-fifths as long as its inner edge; segment 5 a little longer than 2, claws strongly asymmetrical, inner one only moderately blunt. Length of fore-wing 10·5, 11·5, 11·5 mm.; hamuli 8, 9, 9. Abdominal petiole not quite as long as hind femur, sides parallel to a little beyond spiracles, then rather strongly diverging, becoming nearly parallel before posterior margin which is fully two and a half times as wide as anterior, spiracular ratio 4 : 5, spiracles moderately projecting, in profile petiole rather thick; membranous emargination of sternite three times as wide as deep. Tergite 2 rather strongly expanded, somewhat longer than broad.

♂. Resembles ♀ in colour but two anterior processes of ocellar spot joined (disc of vertex entirely dark), though somewhat nebulous; propodeum without dark antero-lateral triangles; tergites 6–7 and sternite 7 (mainly) dark. Pubescence as in female but that of clypeus and supraclypeal plate short and silvery; sternite 7 with short dense outstanding pubescence; length (H. + Th. + T1 + T2) 8·5–9·5 mm.

Structurally resembles ♀, except :—mandibles shining, unpunctured, more convex, with three distal teeth; width of clypeus where eyes approach most closely three-quarters its length, ventral margin gently rounded; tentorial pits four times as far from antennal sockets as from eyes, separated from latter by 3–4 diameters; antennae with segment 3 a little longer than 1 + 2, distinctly so than 4 + 5, six times as long as broad, 4–10 progressively becoming a little shorter, 4 twice, 10 rather more than once as long as broad, 11 and especially 12 considerably longer than 10, 12 as long as 7, 13 as long as 5, nearly four times as long as broad, antennae subspirally rolled, not long ciliate nor shining beneath; dorso-lateral margin of valve-plate of propodeum acute (2 spec.) or subacute (3 spec.); length of fore-wing 10·0–11·0, average 10·4 mm.; hamuli 6–8, average 7·0; sternites 4–6 with posterior margin hyaline but not reflexed, 7 flattened. Genitalia (fig. 101), see p. 430.

Specimens examined :—British Guiana : Essequibo R., Moraballi Creek, dark forest, 9.ix.1929, type ♀, allotype ♂, paratypes 2 ♀, 3 ♂ (nest 1813) (*Oxford Univ. Exped.*) (B.M.), same place, 21.ix.1929, ♂ no. 2509 (*Oxford Univ. Exped.*) (B.M.).

In the Muséum national, Paris, I examined the type ♂ of *Megacanthopus lemoulti* du Buysson, 1908 : 217, French Guiana : Bas Maroni, Les Hattes (*Le Moult*). It is probably the same as the present species but abdominal segments 3–7 are black. If this is later confirmed, my name will be required for a distinct variety.

One nest has been examined, no. 1813, British Guiana : Essequibo R., Moraballi Creek, 9.ix.1929 (pl. 1, fig. 120), hanging from root over waterfall. It is a dark brown nest made of irregularly shaped flattened wood-particles of various sizes. It is rather well covered with somewhat shining dark varnish which becomes thicker on the petiole. The petiole is incomplete but is now 5·0 mm. long and broadens into a rather narrow cone of attachment. The cells fall into seven rows in two directions nearly at right angles to one another, 7 P., 8, 8, 7, 7, 6, 3 = 46 cells. The petiole is attached to a cell at the end of the row and the comb forms an isosceles triangle with the petiole at the apex and a row of new cells along the opposite base (19·0 mm. long); the other sides of the triangle are 31·0 mm. The completed cells are 19·0 × 3·0 mm. The proximal surface of the comb is somewhat concave and slopes obliquely away from the petiole; it is regularly mamillated. The sides of the external cells are each convex, not flattened as in *M. collaris* (Ducke), etc. The distal surface of the comb is rather irregular, with the cocoons mostly about the centre. The cocoon-caps are little domed, of greyish-white fibrous silk with a little carton plastered on, attached 0·5–1·0 mm. below the distal end of the cell.

Mischocyttarus cleomenes sp. n.

♀. Bright yellow with black markings; tip of mandibles and ventral margin of clypeus reddish; antennae orange, segments 1 or 1–3 black dorsally; ocellar mark black, anterior process narrow and tapering, just reaching antennal sockets, yellow spot between ocelli large, " wings " absent, occiput broadly black, mark connected to ocellar mark and (broadly) to eye, occipital stripe extending behind dorsal quarter of eye; pronotum with spot covering central half to nearly whole of area in front of keel and stripes on dorsal lobes black; meso-notum black with four yellow stripes, central pair separated by about their width, lateral pair short, on actual margin; scutellum with narrow anterior margin, central line and

posterior quarter or half black (anterior edge of black straight); postscutellum with very narrow posterior black border; propodeum with central stripe, transverse stripe just above orifice and long antero-lateral triangles black; pleural sutures and meso-metapleural sutures black; inner side of mid coxa, its condyle, dorsal side of trochanter and of proximal third of femur, black; central dorsal stripe of hind coxa, its condyle, dorsal side of trochanter, postero-dorsal two-thirds of femur, black; tergite 1 with anterior three-quarters black, a spot (sometimes centrally divided) just after dorsal muscle yellow; tergites 2–6 black, posterior third or quarter of 2–4 yellow, 5 and 6 indefinitely yellow posteriorly, posterior edge of black parts straight; sternite 1 with some black marks about centre or largely black, 2–6 yellow. Tegulae yellow. Wings hyaline, pterostigma and veins yellow-brown. Pubescence as in *M. sylvestris* sp. n. but sparser on the abdominal petiole. Length (H. + Th. + T1 + T2) 7·0–8·0 mm.

Structurally resembles *M. sylvestris* sp. n., except in the following particulars :—head and thorax with finer sculpture, mesopleuron especially rather more shining; width of clypeus where eyes approach most closely three-quarters to four-fifths length, ventral margin with less of its width produced, more obtuse, not bidentate; tentorial pits somewhat closer to eyes; antennal segment 3 at least as long as 1; eyes separated ventrally by hardly more than half as much as dorsally, in contact with clypeus for a rather longer stretch; ocelli separated by rather more than their diameter, POL : OOL = about 2 : 3; occiput behind eyes dorsally twice POL; tempora one-third eye-width; pronotal keel strong, straight, not sloping backwards in centre, laterally ending rather abruptly in small lobes which are a little reflexed; central furrow of propodeum very weak, dorso-lateral margin of valve-plate acute (2 spec.) or subacute (2 spec.); length of fore-wing 7·0–10·0, average 8·8 mm.; hamuli 7–8, average 7·8; abdominal petiole about as long as hind femur, spiracular ratio 2 : 3, in profile considerably thinner.

♂. Resembles ♀ except in following particulars :—antennae with a black stripe beneath segment 1, 3–6 more or less darkened dorsally; ocellar mark not connected to occiput; tergites 6–7 yellow, most of sternite 1 black beneath; length (H. + Th. + T1 + T2) 8·5 mm.

Differs structurally from ♀ as usual in this group, except :—antennae with segment 3 distinctly longer than 1 + 2 or 4 + 5, segments 4–10 a little shorter, 4 not quite twice as long as broad, 13 as long as 4; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 9·5 mm.; hamuli 7. Genitalia, see p. 430.

Specimens examined :—Mexico : N. Yucatan, Temax, type ♀ (*Gaumer*) (B.M.). Panama : Canal Zone, Barro Colorado Is., 20.viii.1934, allotype ♂ (*O. E. Shattuck*) (J.B.); paratypes, same place, 12.ii.1929, ♀ (*S. W. Frost*) (J.B.); Cabima, 18.v.1911, ♀ (*A. Busck*) (U.S.N.M.); La Chorrera, 12.iv.1912, ♀ (*A. Busck*) (U.S.N.M.); Las Sabanas, 28.x.1928, ♀ (*Dietz and Zetek*) (U.S.N.M.).

I have examined one small nest (pl. 1, fig. 121) which came with the female specimen from La Chorrera, 12.iv.1912 (U.S. Nat. Mus.). It is cream-coloured, made of moderate-sized suboval flattened wood-particles covered with a rather heavy varnish. The petiole is 3·5 × 1·5 × 1·0 mm., a little broadened on to a small attachment-plate. At the other end it passes insensibly into the proximal end of the largest cell, at the end of the middle row (*i.e.* eccentric).

The cells are 1, 2 P., 1 = 4. Two cells contain eggs attached about 3·0 mm. from the proximal end. No cell is complete but one is 10·0 × 3·0 mm.

Mischocyttarus confusus Zikán, 1935 : 195.

♀. Head yellow; mandibular teeth and ventral margin of clypeus pitchy; antennae black dorsally, orange ventrally; supraclypeal plate black; large black ocellar mark with broad anterior processes extending to antennal sockets where a little produced both laterally

and inwards, not bearing yellow spot between ocelli nor lateral " wings," black occipital stripe extending half-way to mandibles behind eyes, broadly connected to ocellar mark and to eyes. Thorax *black*; ventral angles, keel and posterior margin of pronotum yellow; narrow discal stripes of mesonotum (separated by three times their width) and short narrow lateral stripes yellow; antero-lateral spots of scutellum, axillae, postscutellum, yellow; propodeum with broad stripes on each side of furrow extending to one-third their length from postscutellum, an oval yellow spot attached latero-ventrally to each stripe, some of parts round orifice yellow; spot at top of prepectus and small one at its ventral angle, elongate spot above postero-ventral corner of mesopleuron, large anterior area on mesosternum, dorsal and ventral spots on metapleuron, sternal parts to which mid and hind coxae are attached, yellow; legs *yellow*, sides of proepisternum, mark on fore trochanter, inner side of mid coxa, most of mid trochanter, dorsal and ventral stripes on femur, central dorsal and incomplete lateral and inner stripes of hind coxa and its condyle, dorsal stripes on femur, distal part of mid and hind tarsal segment 5 black; abdomen *black*, tergites 1–6 with narrow posterior yellow band broadening a little at sides, tergite 1 sometimes with a small anterior pale spot, sternites 1–5 with broader, sinuate, posterior yellow bands, sternite 6 mostly yellow. Tegulae brown with posterior yellow spot. Wings hyaline with costal margin and veins yellow-brown. Pubescence as in *M. sylvestris* sp. n., but that of abdominal petiole shorter and sparser. Length (H. + Th. + T1 + T2) 9·5 mm.

Structurally resembles *M. sylvestris* sp. n., except in the following particulars:—clypeus perhaps a little longer, tip of produced part not bidentate; tentorial pits closer to eyes; eyes a little closer together ventrally, in contact with clypeus for a longer distance; ocelli separated by a little more than their diameter, POL : OOL = 1 : 1·75; occiput behind eyes dorsally twice POL; pronotal keel strong, a little concave anteriorly, sloping backwards somewhat in centre, laterally ending rather abruptly in small lobes which are a little reflexed; central furrow of propodeum very weak, dorso-lateral margin of valve-plates obtuse or acute; length of fore-wing 10·5, 10·5 mm.; hamuli 8, 10; abdominal petiole hardly as long as hind femur, spiracular ratio 2 : 3, petiole less campanulate, in profile considerably broader.

Specimens examined:—Brazil: Rio de Janeiro, Corcovado, 19.v.1912, ♀ (*G. E. Bryant*) (B.M.); " Upper Amazons," ♀ (B.M.).

I am a little doubtful if the second specimen bears a correct locality label; it is somewhat more broadly yellow-marked than the first, which agrees closely with Zikán's description of a single female from near Rio.

A third specimen—Brazil: Minas Geraes, Lassanoe, 9–19.xi.1919, ♀ (C.)—probably belongs to this species though it is considerably more yellow and the black is partly replaced by ferruginous. The abdominal petiole also seems to be a little narrower. The following is a description of it.

♀. Yellow; mandibular teeth and ventral margin of clypeus reddish; antennae orange, brown to dark brown dorsally; ocellar mark black, anterior process parallel-sided, truncate at level of antennal socket where the two arms are widely separated, a small black inter-antennal spot, yellow spot between ocelli small, lateral " wings " absent, occiput broadly black, mark broadly connected to eye and to ocellar mark, occipital stripe extending behind dorsal half of eye; pronotum with spot covering nearly whole of area in front of keel and moderate stripes on dorsal lobes black; mesonotum black with four yellow stripes, central pair separated by twice their width, lateral pair short, on actual margin; scutellum with anterior margin, central line and posterior triangle black; postscutellum with narrow black border; propodeum with central stripe, antero-lateral triangles widely separated from the dorsal incomplete lateral stripes and some marks above the orifice brown to black; pleural sutures and large mesosternal mark extending to prepectus brownish-black; mid coxa with inner side brown, condyle black, femur with two dorsal brown stripes; hind coxa with

condyle black, coxa with complete dorsal and incomplete external stripes, trochanter, two stripes on femur and tarsal segments 3–5 brown; abdominal segment 1 brown, rather narrowly yellow anteriorly and posteriorly; tergite 2 brown, 3–6 black, 2–5 with narrow posterior yellow bands; sternites 2–6 yellow, irregularly black spotted; tegulae yellow; wings somewhat yellow tinged. Length (H. + Th. + T1 + T2) 9·0 mm.

Dorso-lateral margin of valve-plate of propodeum obtuse; length of fore-wing 10·0 mm.; hamuli 8.

Zikán (1935 : 195–6, pl. 3, fig. 10) described *M. confusus* from a single female seated on a nest on the underside of an orange-leaf, Itatiaya, near Rio de Janeiro. The photograph of the nest shows an irregularly circular comb of about 14 cells.

Mischocyttarus surinamensis (Saussure).

Polybia surinamensis Saussure, [1854] : 200.

♀. Colour-pattern described under the varieties. Structurally resembles *M. sylvestris* sp. n. except in the following particulars :—pubescence considerably sparser, especially on abdominal petiole; length (H. + Th. + T1 + T2) 8·0–9·0 mm.

Sculpture of head and thorax somewhat finer; width of clypeus where eyes approach most closely rather less than its length, ventral margin almost more strongly produced but not bidentate; tentorial pits closer to eyes; antennal segment 3 longer than 1; eyes somewhat closer ventrally, in contact with clypeus for a longer distance; ocelli separated by rather more than their diameter, POL : OOL = 1 : 2 or 1 : 1·75; occiput behind eyes dorsally about twice POL; pronotal keel strong, a little concave anteriorly, sloping backwards somewhat in centre, laterally ending rather abruptly in small lobes which are a little reflexed; central furrow of propodeum very weak; abdominal petiole longer than hind femur, considerably longer and narrower both in dorsal view and in profile, spiracular ratio 4 : 7, membranous emargination of sternite somewhat deeper.

♂. Structurally differs from ♀ as usual in this group, except :—antennae with segments 3–8 more distinctly pubescent behind though hardly ciliate; genitalia, see p. 430. The petiole is longer and narrower in this species than in any other of the group.

Mischocyttarus surinamensis var. **occidentalis** var. n.

♀. Yellow; mandibular teeth and ventral margin of clypeus pitchy-red; antennae orange, dorsally black to dark reddish-brown (in Blairmont spec. reddish-brown), segment 3 usually more reddish dorsally, 1–2 yellow beneath; black ocellar mark sending processes which narrow anteriorly to antennal sockets (7 spec.), or half-way to them (Moraballi spec.), or anterior processes very reduced (Blairmont spec.), bearing an elongate yellow spot between ocelli but no lateral "wings," occipital mark transverse, emarginate in centre anteriorly or (Moraballi spec.) divided or almost absent (Blairmont spec.), not connected to ocellar mark but connected to postero-dorsal corners of eyes. Pronotum with spot in front of keel (about half its width) black (6 spec.) or brown (3 spec.), stripes on dorsal lobes rather narrow, black (7 spec.) or brown (2 spec.); mesonotum black (7 spec.) or red-brown (2 spec.) with four yellow stripes, lateral pair abbreviated anteriorly, lying on margin, central pair separated by rather less than their width; scutellum with anterior and posterior borders narrowly black (7 spec.) or posterior quarter to half black (2 Mazaruni spec.), anterior border of black somewhat angled; postscutellum with posterior margin not or very narrowly black; propodeum with central stripe narrow black (8 spec.) or only so on ventral third (Blairmont spec.), antero-lateral triangles fused with lateral stripes but pale reddish-brown (8 spec.), triangle partly black (1 spec. Mazaruni, which also has a narrow transverse black band above orifice); mesopleural and meso-metapleural sutures black-marked (7 spec.), reddish-brown (Moraballi spec.), or yellow (Blairmont spec.); mid coxa

with dorsal stripe black (5 Kaieteur spec.) or brown (4 spec.), trochanter and proximal half of femur blackish marked dorsally in darker specimens; hind coxa with dorsal stripe and dorsal side of trochanter and femur black (5 Kaieteur spec.) or brown, last one or two segments of tarsus darkened; abdomen *black*, tergite 1 with anterior quarter, tergites 1–5 with posterior fifth and sides more or less, yellow; sternites yellow. Tegulae testaceous with large posterior yellow spot. Wings hyaline, pterostigma and venation yellow-brown, wing-length 9·0–10·0, average 9·6 mm. Dorso-lateral margin of valve-plate of propodeum acute (3 spec.), subacute (5 spec.) or obtuse (1 spec.); hamuli 7–8, average 7·6.

♂. Like the darker of the two Moraballi ♀, except :—antennae entirely black above; black ocellar mark with processes not narrowing anteriorly, meeting on mid line just between antennae and sending small processes towards eye-emargination; last three segments of mid and hind tarsi blackened; wing-length 9·5 mm.; dorso-lateral margin of valve-plate of propodeum subacute; hamuli 8.

Specimens examined :—British Guiana : R. Potaro, Kaieteur Plateau, Tukeit trail, high forest, 3.ix.1937, 5 ♀, including type (nest 184) (*Richards and Smart*) (B.M.); Mazaruni Settlement, second-growth forest, 23.viii.1937, ♀ (nest 93), 23.ix.1937, ♀, 26.viii.1937, allotype ♂ (*Richards and Smart*) (B.M.); Essequibo R., Moraballi Creek, high forest, 24.x.1929, ♀ (*Oxford Univ. Exped.*) (B.M.); Blairmont, 4.viii.1923, ♀ (*H. E. Box*) (B.M.).

The larva is described on p. 430.

Mischocyttarus surinamensis var. *surinamensis* (Saussure).

♀. Yellow; mandibular teeth and ventral margin of clypeus pitchy-red; antennae orange, dorsally orange to brown, segment 1 always dorsally blackish, 1–2 yellow ventrally; black ocellar mark sending processes which narrow anteriorly the whole way (1 spec., San Antonio), two-thirds of the way (6 spec.), or half-way (1 spec., Manáos); ocellar mark not closed in front or behind in this spec.) to antennal sockets, bearing an elongate yellow spot between ocelli but no lateral " wings," occipital mark broad (1 spec., San Antonio), deeply emarginate in centre (6 spec.) or practically absent (1 spec., Manáos), not connected to ocellar mark but more or less connected to postero-dorsal corners of eyes. Pronotum with spot in front of keel (one-third to one-half its width) and stripes on dorsal lobes black or (1 spec., Manáos) brown; mesonotum black or (1 spec., Manáos) brown, with four yellow stripes, lateral ones abbreviated anteriorly, lying on margin, central pair separated by about or rather less than their width (yellow stripes much broader in 1 spec., Manáos); scutellum with narrow anterior and posterior margins and central line black, with a posterior, subtriangular, dark cloud (except 3 spec., Surinam and Manáos); postscutellum with posterior margin hardly darkened; propodeum with narrow central stripe black or (1 spec., Manáos) only so in ventral quarter, reddish-brown suffusion of antero-lateral triangle and of lateral stripes less distinct than in var. *occidentalis* var. n.; mesopleural and meso-metapleural sutures black marked (except 1 spec., Manáos); mid coxa with dorsal stripe, dorsal side of trochanter, proximal third or more of femur dorsally, proximal two-thirds of tibia red-brown (6 spec.), tibia and almost all femur yellow (1 spec., Bolivia), leg yellow (1 spec., Manáos); hind leg similarly marked with same two exceptions, condyle black (1 spec., S. Antonio), fuscous (1 spec., Ega), or yellow (6 spec.); abdomen *reddish-brown* (darker in 2 spec., Bolivia) with anterior quarter of tergite 1, posterior fifth of tergites 1–5, and all sternites yellow. Tegulae testaceous, with posterior yellow mark. Wings hyaline, pterostigma and venation yellow-brown, wing-length 9·0–10·5, average 9·6 mm. Dorso-lateral margin of valve-plate of propodeum acute (2 spec.) or subacute (6 spec.); hamuli 7–9, average 7·8.

♂. Resembles ♀, except :—antennae hardly any more darkened above; one spec. (Teffé) with anterior processes of ocellar black mark meeting on mid line and produced towards eye-emargination, other spec. as in ♀, ocellar and occipital marks just connected

(Teffé spec.); scutellum with posterior black triangle in Teffé spec.; yellow banding of abdomen more distinct in Teffé spec. (owing to darker ground-colour), hardly distinguishable in Manáos spec.; wing-length 8·0, 9·0 mm.; dorso-lateral margin of valve-plate of propodeum subacute; hamuli 6, 7.

Specimens examined :—Surinam : Paramaribo, 30.i.1920, 2 ♀ (*Bollow*) (D.E.I.). Brazil : Amazonas, Ega, ♀ (B.M.), Teffé, 1.x.1904, ♂ (*A. Ducke*) (B.M.), Manáos ♂♀ (*Ule*) (B.); ii.1896, ♀ (*E. E. Austen*) (B.M.); Guiana, San Antonio do Icá, 19.ix.1906, ♀ (*A. Ducke*) (B.). Bolivia : Coroico, 2 ♀ (B.).

This variety differs from var. *occidentalis* var. n. in the brown (not black) ground-colour of the abdominal tergites, in the paler dorsal surface of the antennae, and in the rather more reduced ocellar mark. De Saussure described the typical form from Surinam and the only two specimens from that colony which I have seen belong to the present variety.

Ducke (1904 : 361; 1904 : 688, pl. 4, fig. 23; 1907 : 189) has given some notes on what was probably the typical variety of this species. He states that the petiole is always eccentric but it is not very obviously so in the nest of 5–6 cells which he illustrates suspended from a small twig. Strand (1912 : 320, pl. 9, fig. 5) also describes a nest which he ascribes to this species but which probably belongs to some other allied species.

FitzGerald (1938 : 183–5) made a number of observations on what was doubtless the var. *occidentalis* in Trinidad where it was found in many localities. It is the commonest species and nests under the eaves of houses in settled districts. Though most nests are small, at least two large ones of 106 and 102 cells were found. The former was in the shape of a spearhead 8·2 cm. long and 2·0 cm. broad at widest point. The whole was suspended from a short stalk from the first-formed cell. The second nest was also spearhead shaped and besides brood in all stages, 2 ♀, 12 ☿ and 21 ♂ were on the comb.

The carton is straw-coloured and, especially when the yellow adults are on it, the nest is very conspicuous. Since, however, this species is indistinguishable in the field from the aggressive *Gymnopolybia pallipes* (Oliv.), it may be protected by being conspicuous. The cocoon-caps are semi-transparent and partly covered with strips of carton. The cells are used more than once.

Some observations were made on colony-formation.

(1) 1 ♀ was sole guardian of 8 cells containing brood of all ages, including one pupa. Five days later a second cocoon was formed. The original ♀ remained on the nest for a further three weeks, when the pupae which had not hatched were examined and found to be parasitised.

(2) A nest of 15 cells was found on which usually only 1 ♀ (probably the original ♀) was on guard in the daytime but three more wasps were present at night. During a fortnight three cells were added and four larvae which were in the nest when found pupated. No adults emerged during this period.

The above examples appear to be typical for the species and tend to show that a single fertile female which can be distinguished in the field by being slightly larger than workers with a comparatively wider head and on dissection by the developed ovaries, constructs a comb and rears 2–3 workers. These latter spend a considerable time away from the nest.

Enemies of the species in Trinidad were an Ichneumonid, a Dipteron which was parasitised by *Signiphora polistomyiella* Rich. (Chalcidoid) (see Richards, 1935), an Attid spider and the swift, *Streptoprocne zonaris albicincta* (Cabanis).

I have examined 3 nests (pl. 2, figs. 142–3) from British Guiana, no. 4765, Moraballi Creek, 24.x.1929, attached beneath mid-rib of leaf; no. 93, Mazaruni Settlement, second-growth forest, 23.viii.1937, underside mid-rib

leaf of small tree, 8 ft. from ground; no. 184, Potaro R., Tukeit–Kaieteur trail, 8.ix.1937, underside mid-rib leaf of *Clusia* sp., 6 ft. from ground.

No. 4765 is a pale greyish nest with carton made of small mainly oval flattened fragments with very little varnish. The petiole is 3·5 × 1·0 × 0·5 mm., with slight buttresses along the mid-rib and a small cone of attachment. It is covered with a thicker reddish-brown varnish and attached to a cell at the edge of the comb. Comb in the form of a shallow cone, one side of which is the side of the petiolar cell, the opposite one the proximal surface of the other cells which is flat and very little mammillated. The distal surface of the comb is subcircular and fairly even, except for two cells with cocoons (petiolar cell and one next to it) which are much longer. The cells are arranged $\frac{3\text{ P., }4, 5, 5, 4, 3}{4\text{ P., }5, 6, 5, 4}$ = 24 cells. New cells are added at ends of all rows farthest from the petiole. The eggs are laid on the side of cells nearest to the petiole, 2·0–3·0 mm. from the bottom. The cocoon-caps are of whitish fibrous silk, attached flush with the distal end of cell, not domed and much plastered over with carton. Completed cells are 13·0 × 3·3 mm.

The carton of nests 93 and 184 is paler, almost whitish, as described by FitzGerald in Trinidad. No. 184 consists of 3, 4 P., 4, 3, 2 = 16 cells. It contained 5 eggs, 4 larvae and 4 pupae and 1 wasp was present. No. 93 consisted of 1 P., 3, 3 = 7 cells. There was 1 wasp, 2 larvae and 2 eggs.

Mischocyttarus garbei Zikán, 1935 : 194.

Colour-pattern described under the varieties.

♂♀. Structurally extremely close to *M. surinamensis* (Sauss.); pronotal keel tending to slope backwards more in centre (but this character shows a complete intergradation); abdominal petiole short and thicker (this character varying somewhat but hardly intergrading); length (H. + Th. + T1 + T2) 8·5–10·0 mm. Genitalia, see p. 428.

Variation.

Mischocyttarus garbei var. *garbei* Zikán, 1935.

♀. Yellow; mandibular teeth and ventral margin of clypeus pitchy-red; antennae orange, dorsally black or dark brown, two specimens light brown, segments 3 and about 10–12 usually somewhat lighter, 1 yellow beneath; ocellar mark brown and very ill defined (9 spec.) or black (3 spec.), sending anteriorly narrowed processes to antennal sockets, bearing an elongate yellow spot between ocelli but no lateral " wings," occipital mark widely interrupted centrally (9 spec.) or only emarginate (3 spec.), not connected to ocellar mark but connected to postero-dorsal corners of eyes. Pronotum with spot in front and half width of keel black (5 spec.) or brown (6 spec.) or absent (1 spec.), stripes on dorsal lobes rather narrow, black or dark brown; mesonotum black or brown with four yellow stripes, lateral pair abbreviated anteriorly, lying on margin, central pair separated by rather more to nearly twice their width (less than their width in Beni spec.); scutellum with anterior and posterior margins and central line narrowly black, posterior half covered by a brown or black triangular mark (10 spec.) or no such mark (2 spec., Bahia, Beni); postscutellum with posterior margin very narrowly black; propodeum with narrow central stripe and stripe across top of orifice black or partly brown, antero-lateral triangles faintly (1 spec. strongly) indicated in brown; marks at middle of prepectal and meso-metapleural sutures black or brown; legs somewhat orange tinged, mid and hind coxae and femora with more or less distinct brown stripes, last two or three segments of their tarsi brown; abdomen brownish-orange dorsally, tergite 1 sometimes yellower on anterior quarter (Beni and Putomayo spec. with tergite 1 anteriorly and 1–3 narrowly posteriorly, yellow), sternites yellow. Tegulae testaceous with posterior yellow spot. Wings hyaline, venation yellow-brown,

length of fore-wing 9·0–11·0, average 10·2 mm.; dorso-lateral margin of valve-plate of propodeum obtuse (6 spec.) or subacute (6 spec.); hamuli 7–10, average 8·6.

Specimens examined :—Brazil : Bahia, 2 ♀ (*Gomez*) (B.), 3 ♀ (*Von Olfers*) (B.); Rio de Janeiro, 4.i.1906, ♀ (*A. Ducke*) (B.M.) [det. as *M. surinamensis* (Sauss.) by Ducke]; Rio Putomayo, Pto. America, 30.viii.1920, ♀ (C.); Monat, iv.1925, ♀ (*P. Sandig*) (J.B.); " Brazil," ♀ (*Virmond*) (B.), 2 ♀ (F. Smith coll.) (B.M.). Bolivia : Rio Beni, Cavinas, ii.1922, ♀ (*W. M. Mann*) (J.B.). Described by Zikán (1935 : 194) from 2 ♀ from Espirito Santo.

Mischocyttarus garbei var. **tricolor** var. n.

♀. Yellow; mandibular teeth and ventral margin of clypeus pitchy-red; antennae orange, dorsally black, segment 1 yellow beneath; black ocellar mark produced anteriorly to antennal sockets, occipital mark deeply emarginate in centre. Pronotum with spot half width of and in front of keel and rather narrow stripes on dorsal lobes black; mesonotum black with four yellow stripes, lateral pair on margin, central pair separated by about their width; scutellum with narrow anterior and posterior margins and central line black, posterior half with triangular dark cloud; posterior margin of postscutellum narrowly black; propodeum with narrow central stripe and narrow stripe above orifice black, long antero-lateral triangles black; middle of prepectal and meso-metapleural sutures black; mid and hind legs yellower than in var. *garbei* Zik., with indistinct dorsal brown stripes, but both condyles black; abdominal tergite 1 orange-brown with anterior and posterior quarters yellow, and tergite 2 reddish-brown with posterior fifth yellow, tergites 3–6 black, 3–5 posteriorly with yellow bands which are one-fifth or less length of tergites in centre and almost whole width at sides, sternites yellow. Tegulae testaceous with large inner yellow spot. Wings hyaline, venation yellow-brown, length of fore-wing 10·0 mm. Dorso-lateral margin of valve-plate of propodeum subacute. Hamuli 8.

Specimen examined :—Brazil : Matto Grosso, Maracajú, iv.–v.1937, type ♀ (*G. Fairchild*) (J.B.).

Mischocyttarus garbei var. **xanthocerus** var. n.

♀. Yellow; mandibular teeth and ventral margin of clypeus pitchy-red; antennae orange, segment 1 dark brown above, yellow beneath; black ocellar mark sending forwards rather broad (not tapering) processes to antennal sockets, bearing an elongate yellow spot between ocelli but no lateral wings, occipital mark narrowed centrally, narrowly connected to ocellar mark, broadly to postero-dorsal corners of eyes. Pronotum with spot in front of keel half its width and moderately broad stripes on dorsal lobes black; mesonotum black with four yellow stripes, lateral pair on margin, central pair separated by more than their width; scutellum with narrow anterior margin and posterior triangle black; postscutellum with narrow posterior triangle black; propodeum with central stripe, transverse stripe above orifice, and elongate antero-lateral triangles, extending down to transverse stripe, black; prepectal and dorsal sutures of mesopleuron, spot in hollow beneath root of fore-wing, dorsal half of meso-metapleural suture, black; mid and hind legs with dorsal stripe on coxae and less distinct one on femora, brown; abdomen rather dark reddish-brown, anterior and posterior quarters of tergite 1, narrow posterior margins, hardly broadening at sides of tergites 2–4, and sternites yellow. Tegulae testaceous with inner margin yellow. Wings hyaline, venation yellow-brown, length of fore-wing 10·0 mm. Clypeus less strongly produced ventrally. Dorso-lateral margin of valve-plate of propodeum subacute; hamuli 8.

♂. Colour as in ♀, except :—anterior processes of ocellar mark meeting between antennae and each sending a process towards eye-emargination; central stripes of mesonotum separated by one and a half times their width.

Structurally differs from ♀ in characters usual for this group; length of fore-wing 9·5 mm.; dorso-lateral margin of valve-plates of propodeum acute; hamuli 9.

Specimens examined :—Bolivia : type ♀, allotype ♂ (*Garlepp*) (B.).

This variety in the female resembles *M. cleomenes* in the shape of the clypeus and in the colour-pattern; the sculpture and the shape of the first abdominal segment resemble *M. garbei* Zik.; the male antennae differ from those of the male I have ascribed to *M. cleomenes* sp. n. and resemble those of *M. surinamensis* (Sauss.) (as would be expected in the male of *M. garbei* Zik.). I feel little doubt that the male and female are correctly associated but more specimens are required to determine their status.

Group of *M. iheringi* Zikán (text-fig. 102).

Characters of the adults given in the key (p. 309). In the ♂ genitalia, the parameral spine is long with rather numerous bristles at the middle, especially on the outer side. The membranous lobe of the digitus is broad and does not extend to the end of the aedeagus. Beneath the aedeagus there are about 16 strong teeth.

Larva. Not known.

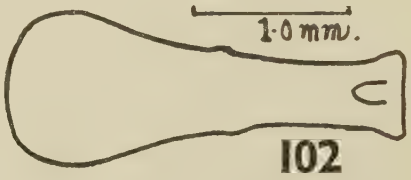


Fig. 102.

Fig. 102. Dorsal view of abdominal tergite 1, *M. iheringi* Zik. ♀.

Nest. According to Zikán (1935 : 177–80, pl. 1, fig. 6) the nest is peculiar in being attached to rocks in such a way that the distal surface of the comb faces the rock, while bits of moss, etc., are attached to the proximal surface of the comb which is therefore very difficult to discover. It is difficult to make out from the figure whether the petiole is eccentric or not; it becomes very thick in large nests.

Mischocyttarus iheringi Zikán, 1935 : 177.

♀. Dull black; mandibles yellow or dirty yellow with teeth pitchy-red; antennae with segment 2 and proximal two-thirds of 3 yellowish beneath, last three, four or five segments orange-brown beneath; clypeus black (3 spec.) or with small lateral yellow spots (1 spec.) or with lateral and ventral quarters yellow (1 spec.); inner orbits from clypeus to centre of eye-emargination bordered with yellow, inner orbit behind eye-emargination also yellow in 3 specimens, a more or less distinct elongate yellow spot in front of anterior ocellus, small yellow spots between posterior ocelli and eyes in 1 specimen, malar space yellow, this area sometimes produced up towards (meeting in 1 spec.) a more or less distinct yellow margin of upper third of outer orbits; foraminal area more or less brown; pronotal keel and posterior margin more or less yellow-tinged, sometimes also area just above ventral angle; mesonotum with narrow (separated by 3–4 times their width), posteriorly abbreviated, yellow discal stripes; scutellum with spot on axillae and sometimes small adjacent spot on scutellum yellow; postscutellum with some marks on its lateral lobes and sometimes (1 spec.) its anterior third yellow; propodeum black with parts round orifice brownish or with two large oval spots on each side of ventral two-thirds of furrow yellow; mesopleuron black or (1 spec.) with centre of prepectus and adjacent pleural spot yellow; metapleuron with dorsal and

ventral spots in 1 specimen; posterior half of mesosternum yellow; proepisternum narrowly yellow margined; fore legs with most of coxa and trochanter, dorsal and ventral stripes of femur, tibia except dorsal stripe, yellow; mid legs with ventral and latero-dorsal stripes on coxa and its condyle, short ventral and larger anterior and posterior stripes on femur, tibia except dorsal proximal two-thirds and extreme tip dorsally, tarsi except segment 5 dorsally yellow; hind legs similarly but less extensively pale-marked, ventral stripe on coxa absent, tibia continuously dark dorsally, all tarsal segments more or less annulated; abdominal tergites 1–3 narrowly yellow-margined posteriorly, margin often centrally interrupted; sternites 2–4 somewhat more broadly yellow-margined, anterior margin of yellow excavated laterally. Tegulae brown. Wings hyaline, costal margin yellow-brown. Head and thorax with short, rather sparse, inconspicuous pale pubescence, that on ventral half of clypeus longer and outstanding; legs and abdomen with appressed, microscopic pubescence (darker on abdomen), bristles on tibiae and tarsi sparse but distinct, abdominal petiole with very sparse outstanding pubescence even beneath, pubescence becoming rather conspicuous, dense and outstanding on sternites 5–6. Length (H. + Th. + T1 + T2) 9·0–9·5 mm.

Head dull, very finely granulate, clypeus (especially ventral third) more shining with sparse punctures. Mandibles shining, with sparse shallow punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest about one-quarter width of antennal socket. Width of clypeus where eyes approach most closely about three-quarters length, ventral margin moderately strongly angularly produced over central two-thirds. Tentorial pits nearly twice as far from antennal sockets as from eyes, well removed from both. Antennal sockets only a little farther from one another than they are from eyes. Antennal segment 3 not quite as long as 1. Eyes separated ventrally by a little less than dorsally, in contact with clypeus for a long stretch. Ocelli in an equilateral triangle, separated from one another by one and a half times diameter of one, POL : OOL = 1 : 2. Occiput not margined dorsally but tempora separated from foraminal depression by a rather strong keel from level of top of eye to nearly half-way to mandibles, width of occiput behind eyes dorsally twice the POL. Tempora a little more than one-half width of eye. Thorax + propodeum twice as long as broad, dull, finely punctured, mesosternum more shining, mesonotum and dorsal part of pronotum finely and closely punctured. Pronotum with anterior margin distinctly raised and a little reflexed, preceded by a deep furrow of which the posterior edge is sharp, sub-laminate; no lateral fovea; keel sharp and strongly raised, laterally ending in slight lobes which are a little reflexed, in dorsal view straight or a little concave anteriorly. Proepisternum with anterior margin weakly raised and reflexed, side weakly margined. Upper division of metapleuron obtusely produced along meso-metapleural suture. Tegulae somewhat dull, lateral margin somewhat truncate. Postscutellum strongly flattened, in same plane as scutellum. Propodeum with no anterior horizontal region, central furrow weak, separated by half its length from postscutellum, with a weak central keel, lateral furrows very weak, valve-plate with dorso-lateral margin obtuse (1 spec.), subacute (2 spec.) or acute (2 spec.). Mid tibia with two long spurs. Mid tarsi with segment 3 distinctly asymmetrical, 4 strongly produced. Hind tarsi with inner lobe of segment 3 much more strongly produced than outer lobe of 4, the outer edge of which is two-fifths as long as its inner edge; segment 5 as long as 2, claws strongly asymmetrical, inner one distinctly blunt. Length of fore-wing 10·5–11·5, average 11·1 mm.; hamuli 10–11, average 10·4. Abdominal petiole a little shorter than hind femur, sides beginning to diverge a little before spiracles, regularly and strongly diverging after them; posterior margin three and a half times as wide as anterior, spiracular ratio 3 : 4, spiracles distinctly though obtusely projecting; petiole ventrally with membranous emargination four times as wide as deep. Tergite 2 moderately expanded, as long as broad.

♂. Resembles ♀ in colour but antennae entirely pale beneath; clypeus and whole face beneath antennae yellow with appressed silvery pubescence; whole mesosternum together

with a patch just posterior to ventral angle of prepectus, yellow; mid coxa yellow ventrally; sternite 7 with short dense pubescence. Length (H. + Th. + T1 + T2) 8·0 mm.

Structurally resembles ♀, except :—mandibles shining unpunctured, more convex, with three distal teeth; width of clypeus where eyes approach most closely equal to its length, ventral margin gently rounded; tentorial pits almost touching eyes, far removed from antennal sockets; antennae with segment 3 considerably longer than 1 + 2, somewhat longer than 4 + 5, six to seven times as long as broad, 4–10 becoming progressively shorter and somewhat narrower, 4 two and a half, 10 one and a third times as long as broad, 11–12 hardly longer but thinner than 10, 13 considerably thinner, as long as 6, three times as long as broad, antennae subspirally rolled, not long ciliate, nor shining beneath; dorso-lateral margin of valve-plate of propodeum subacute; length of fore-wing 9·0 mm.; hamuli 11; sternites 4–6 with posterior margin hyaline but not reflexed, 7 flattened. Genitalia described on p. 440.

Specimens examined :—Brazil : Rio de Janeiro, Barao Homem de Mello, ♂, 5 ♀ (*J. Zikán*) (D.E.I.).

Zikán (1935 : 177–80, pl. 1, fig. 6) found a number of nests at Itatiaya, near Rio de Janeiro. The nest probably harmonises better with its surroundings than that of any other species in that region. The colour is light to dark grey and the shape an irregular circle. It is always fastened to rocks, except one which was found on the mud wall of a hut. Unlike other species, the cells are so directed that their distal ends face the rock to which the comb is attached. The rock thus acts as a roof and the two are so extremely like in colour that the nests can only be discovered by accident. Small bits of moss, like those on the rock, are attached and holes or depressions like those due to erosion are often present. Like all similar hidden nests, it is somewhat irregular and the cells are very oblique to the surface to which the nest is attached. The petiole is round and thin in small nests but becomes much thicker in big nests. The largest nest found had 2–6 cells in 16 rows. On it were 1 ♂, 20 ♀ and an Ichneumonid. Between 27.i. and 25.ii., 14 ♂, 41 ♀ and 5 Tachinids emerged. A smaller nest discovered nearly on the same day had 70 cells in 7 rows. 3 ♂, 8 ♀ were present and up to 17.ii. it produced further 1 ♂, 6 ♀, 7 Tachinids and 1 Ichneumonid.

Group of *M. cerberus* Ducke (text-figs. 103–4).

Characters of the adults described in the key (p. 309). In the male genitalia, the parameral spine narrows rather suddenly near its tip and bears rather numerous bristles on most of its length. The membranous lobe of the digitus is broad and very long, extending to the end of the aedeagus. The aedeagus is considerably narrowed distally (fig. 104) and bears 12 strong teeth beneath.

Larva. Described by Reid (1941 : 322, figs. 124–6, 129) for the var. *acheron* Rich. There are two parallel rounded lobes on the first abdominal sternite. There are no bristles on the ventral surface except on the lobes where they are pale. There is no knob on the tenth abdominal tergite. The head and labrum are both brown.

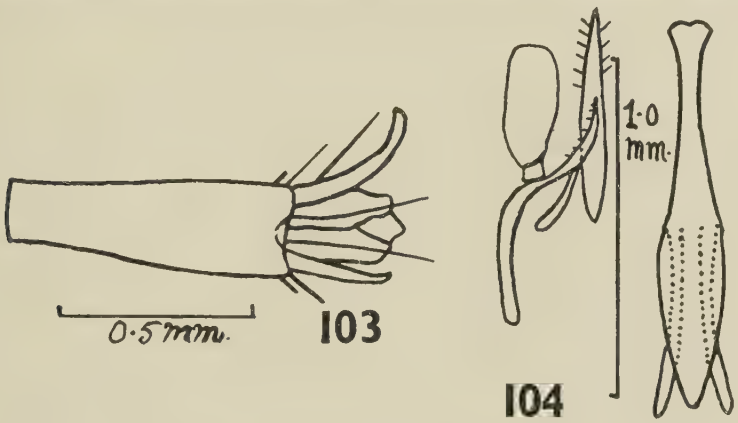
Nest. The petiole is eccentric and somewhat flattened and attached to either the upper or underside of leaves, or to houses. The combs appear to be subcircular but as new cells are added at points farthest away from the petiole, they tend to elongate. The eggs are laid on the side of the cells farthest from the petiole.

Mischocyttarus cerberus Ducke, 1918 : 371.

♀. Colour-pattern described under each variety. Surface of head and thorax with short, inconspicuous, pale pubescence, clypeus with outstanding reddish bristles; legs and

abdomen with appressed, pale, microscopic pubescence (dark on dark parts of abdomen), tibiae and tarsi also with short, outstanding, reddish bristles; abdominal segment 1 with very little outstanding pubescence, a little on sternites 2–4, and quite long and dense on sternites 5–6. Length (H. + Th. + T1 + T2) 8·0–9·0 mm.

Head rather dull, hardly perceptibly sculptured, clypeus more shining with sparse, moderately large punctures. Mandibles shining, with sparse, large punctures, proximal half flattened and ventrally sharp-edged, four distal teeth, dorsal one short. Malar space one-quarter as long as width of antennal socket. Width of clypeus where eyes approach most closely a little greater than its length, ventral margin not depressed, obtusangularly but quite strongly produced over its whole width. Tentorial pits one and a half to twice as near to eyes as to antennal sockets, well separated from eyes. Antennal sockets distinctly less than twice as far from one another as from eyes. Antennal segment 3 a little shorter than 1. Eyes separated ventrally by three-quarters as much as dorsally, in contact



Figs. 103–4.

Fig. 103. Left hind claws in dorsal view, *M. cerberus* Ducke ♀.
104. Aedeagus in dorsal view and volsellar plate and parameral spine in ventral view, *M. cerberus* Ducke ♂.

with clypeus for a moderate stretch. Ocelli in an equilateral triangle, separated from one another by more than one and a half times the diameter of one, POL : OOL = 2 : 3. Occiput not margined, its width behind eyes dorsally one and a half times POL. Tempora nearly one-half width of eye. Thorax + propodeum nearly twice as long as broad, dull, mesonotum granulate, otherwise not perceptibly sculptured. Pronotum with anterior margin strongly raised but not reflexed, preceded by a furrow the posterior margin of which is acute, laminate; no lateral fovea; keel continuous, rather strong, not stronger at sides than at centre, about straight or a little concave anteriorly, actual lateral extremities a little reflexed. Proepisternum with anterior margin rather strongly raised but little reflexed, sides feebly margined. Upper division of metapleuron rather acutely produced along meso-metapleural suture. Tegulae dull, lateral margin in an almost regular curve. Postscutellum flattened, but not forming continuous curve with scutellum. Propodeum with no anterior horizontal region, central furrow shallow and ill defined, not reaching postscutellum, lateral furrows obsolete. Mid tibiae with two spurs of nearly equal length. Mid tarsi with segment 3 strongly asymmetrical, segment 4 strongly produced. Hind tarsi with inner lobe of segment 3 much more strongly produced than outer lobe of segment 4, the outer edge of which is half as long as its inner edge; segment 5 not quite as long as 2, claws not strongly asymmetrical; larger claw sharp. Abdominal petiole hardly as long as hind femur, sides gradually and almost regularly diverging throughout (rather more after spiracles), posterior

twice as wide as anterior margin, spiracular ratio 3 : 4, spiracles very slightly projecting; petiole ventrally with membranous emargination nearly four times as wide as deep. Tergite 2 moderately expanded, a little longer than broad.

♂. Differs from ♀ as follows :—clypeus with short, dense, silvery pubescence, ventral margin regularly, not very strongly curved, about as long as broad. Mandibles shining, unpunctured, three distal teeth, ventral one much longer than other two. Tentorial pits three times as near to eyes as to antennal sockets. Antennae with segment 1 rather thick, more than half as wide as distance between sockets, 3 about as long as 1 + 2 or as 4 + 5, five times as long as broad, 4–8 gradually decreasing in length and increasing in thickness, 4 twice, 8 just more than once as long as broad, 9–12 becoming progressively thinner but all about as long as 8, 13 three times as long as broad, as long as 6, antennae distally spirally rolled, no segment ciliate nor with shining area beneath. Clypeus in contact with eyes for a longer stretch. Tempora one-third eye-width. Sternites 3–6 with posterior margins hyaline but not reflexed, 7 flattened. Genitalia described on p. 442, fig. 104.

Mischocyttarus cerberus var. *cerberus* Ducke, 1918 : 371.

♀. Yellow with black or dark brown markings; tips of mandibular teeth and ventral margin of clypeus pitchy-red; antennae dorsally (except proximal half of segment 1), ocellar mark extending to antennal socket or stopping short just in front of ocelli, the mark enclosing an elongate yellow spot between ocelli, transverse mark on occiput, enclosing a yellow, transverse spot, not or narrowly joined to ocellar mark, broadly joined to posterior orbit, dorsal fifth of which is narrowly dark, *black*; pronotum with or without brown spot in front of keel, stripes on dorsal lobes feebly indicated in brown; mesonotum with three brown or blackish-brown stripes, separated by about their own width; scutellum very narrowly dark anteriorly and posteriorly, in one specimen with triangular, brown, posterior suffusion; postscutellum narrowly dark posteriorly; propodeum with central furrow dark; mesopleuron with spot in hollow beneath fore-wing and prepectal furrow dorsally, dark; mid coxae with inner surface dorsally brown, condyle yellow, femur with dorsal brown stripe; hind coxa with central brown stripe, condyle yellow, femur with dorsal brown stripe; abdomen with tergite 1 becoming brownish on distal half, tergites 2–6 blackish-brown (except anterior fifth of 2), sternites yellow. Wings hyaline or with costal margin yellow suffused. Dorso-lateral margin of valve-plates of propodeum subacute or obtuse (♀), subacute ♂. Length of fore-wing 9·0, 9·5 (♀), 9·0 (♂) mm.; hamuli 8, 9 (♀), 8 (♂).

Specimen examined :—Brazil : Guiana, Faro, 3.ix.1907, ♀ (*A. Ducke*) (B.M.) [det. Ducke]. Dutch Guiana : Paramaribo, ix.1907, ♂♀ (*C. Heller*) (B.).

Ducke (1918 : 371) mentions a variety *cerberus* du Buysson *in litt.* of *M. surinamensis* (Sauss.). The only description is the statement that the petiole is shorter and more cylindrical and the locality records :—" Maranhao : Caxias, Connu du bas Amazon." Ducke did not designate holotypes, but it is probable that the Caxias specimen[s] is in the Museu Goeldi. A British Museum specimen is from Faro and determined by Ducke. Three specimens marked as types by Ducke are in the Paris Museum but belong to a different species, *M. synoecus* Rich. (p. 450). I propose (Richards, 1940 : 179) to restrict the name *cerberus* to the species described above.

Mischocyttarus cerberus var. *acheron* Richards, 1940 : 179.

♀. Differs from var. *cerberus* Ducke as follows :—black ocellar mark extending to antennal socket; black mark on occiput rather more extensive, enclosed spot small, subcircular, or nearly absent; pronotum with distinct brown spot in front of keel and on dorsal lobes; mesonotum better described as black with 4 rather narrow yellow stripes; propodeum with pale brown antero-lateral triangles; condyles of mid and hind coxae black with a yellow central spot; hind tarsi with segments 3–5 dark brown; abdomen

with tergite 1 dark brown with anterior quarter and posterior sixth (except very narrow margin), *sulphur yellow*; tergites 2–6 black with anterior fifth of 2, and narrow posterior bands of 2–5, *light yellow*; sternites entirely yellow. Wings a little infuscate. Dorso-lateral margin of valve-plate of propodeum acute (6 spec.) or subacute (6 spec.). Length of fore-wing 8·5–9·5, average 9·0 mm.; hamuli 7–9, average 7·8.

Specimens examined :—British Guiana : Mazaruni Settlement, 1937 (*Richards and Smart*) (B.M.), 17.viii. (nest 39), ♀ type, 27.viii. (nest 119), 2 ♀, 28.viii. (nest 128), ♀, 28.viii. (nest 129), ♀, 28.viii., flying, ♀, 14.ix. (nest 265), 3 ♀, 17.ix., in Colony house, ♀, 21.ix. (nest 289), 2 ♀.

Mischocyttarus cerberus var. *styx* Richards, 1940 : 180.

♀. Differs from var. *cerberus* Ducke as follows :—black ocellar mark extending to antennal socket; black occipital mark more extensive, not enclosing a yellow spot; spot in front of pronotal keel more distinct; black stripes of mesonotum considerably broader; propodeum with antero-lateral triangles more or less indicated in brown, lateral stripes indicated by small spot in depression; bottom of mesopleuron sometimes with a brown spot; condyles of mid and hind coxae black with yellow central spot; mid and hind tarsi with last three segments blackish; abdomen with segments 1–2 (dorsally and ventrally) brownish-yellow, 3–6 (dorsally and ventrally, except anterior half of sternite 3), black. Wings a very little infuscate. Dorso-lateral margin of valve-plate of propodeum subacute. Length of fore-wing 9·0, 9·5 mm.; hamuli 8, 9.

Brazil : São Paulo, Dumont, from two nests, 11.vii.1923, 2 ♀ (*H. B. Cott*) (B.M.).

I have examined two nests (pl. 2, figs. 150–1) of the var. *styx*, no. 401–2, Brazil : São Paulo, Dumont, 11.vii.1923, on leaf of mango (*H. B. Cott*), and six nests (pl. 2, figs. 147–9) of the var. *acheron*, British Guiana : Mazaruni Settlement, clearing, 1937, no. 119, 27.viii., under beam of open shed, 8 ft. from ground; no. 265, 14.ix., under leaf of Yucca, 1 ft. from ground; no. 39, 17.viii., upperside leaf of tree, 8 ft. from ground; nos. 128–9, 239, 28.viii. and 21.ix., upperside leaves of mango, 8–12 ft. from ground. Nos. 128–9 were on the same mango as the nests of *M. injucundus* (see p. 352) and of the ant, *Dolichoderus bidens* (L.).

No. 401 is a reddish-brown nest with carton made of rather large mostly oval wood-fragments, rather shining, heavily varnished, with a few transparent windows. The petiole is 3·0 × 1·0 × 0·5 mm., flattened along the axis of symmetry of the comb and attached to a cell at the end of a row. The buttresses are very slight, the attachment-plate circular, 3·0 mm. in diameter and the cone of attachment slight. The cells are arranged $\frac{2\text{ P., }3\text{ (1 C.), }3,\ 2}{3,\ 4\text{ P., }3} = 10$ cells. The comb is subcircular and new cells are added at the edge farthest from the petiole. The external cells have their outer sides strongly convex. The distal surface of the comb is very irregular and the proximal surface nearly flat and very oblique to the petiole. The completed cells are 12·0 × 3·0 mm. Eggs are laid 2·0–3·0 mm. from the bottom of the cell on the side farthest from the petiole. The cocoon-caps are of semi-transparent fibrous silk, almost flush with the distal ends of the cells and heavily plastered over with carton. No. 402 is similar with 2 P, 3, 2 = 7 cells.

The nests of the var. *acheron* are all light grey and were all found in rather exposed situations. The carton is made of small mainly oval fragments. There is not much varnish on the dullish sides but the proximal surface is more varnished and shining. The general arrangement of the nest, including the

position of the egg, does not differ from no. 401. The petiole is always attached to an external cell. Table 8 gives the details of the six nests.

Table 8.

Nest no.	Cells	Wasps present	Eggs	Larvae	Pupae	Empty cells	Remarks
265	29 cells (damaged)	1 ♀	7	10	5	7	
119	3 P., 4, 3, 2 = 12	2 ♀	4	4	2	1	
39	3 P., 3, 3, 2 = 11	1 ♀	4	4	2	1	
129	2 P., 3, 3, 2 = 10	1 ♀	3	5	1	1	
289	3 P., 4, 3 = 10	2 ♀	2	7	0	1	The two cells containing eggs had small drops of honey-like liquid near the mouth.
128	2 P., 3, 2 = 7	2 ♀	4	1	0	2	No cell more than half complete.

Group of *M. artifex* (Ducke) (text-figs. 105–19).

The characters of the adults are described in the key (p. 309). The ♂ genitalia have been examined in *M. oecothrix* Rich. and *M. thrypticus* sp. n. In the first-named (fig. 117), the pointed part of parameral spine is unusually short, as in *M. cerberus* Ducke, and it bears only a few short setae. The membranous lobe of the digitus is broad. The aedeagus bears about 12 teeth beneath. In *M. thrypticus*, the genitalia only differ from *M. cerberus* in some obscure details of the digitus.

Larva. Reid (1941 : 323, figs. 114, 121) has described the larvae of *M. synoecus* Rich. and *M. oecothrix* Rich. They agree in having two parallel ventral lobes with rounded ends on the first abdominal sternite. There are no bristles on the ventral surface except on the lobes and there they are grey to black. There is no dorsal knob on the tenth tergite. The labrum is pale, not brown as in *M. cerberus* Ducke but the head is partly dark-marked.

M. oecothrix differs from *M. synoecus* in having the genae and clypeus deep brown to black and the rest of the head straw-coloured (instead of having the genae only smoky-suffused) and the bristles are numerous, fine and greyish to dark brown (not coarse, not numerous and brown to blackish).

Nest. Two very different sorts of nest have been recorded in this group. *M. oecothrix* Rich. and *M. artifex* (Ducke) make long nests of one or at most two rows of cells. *M. synoecus* Rich. makes a very ordinary small roundish comb with an eccentric petiole.

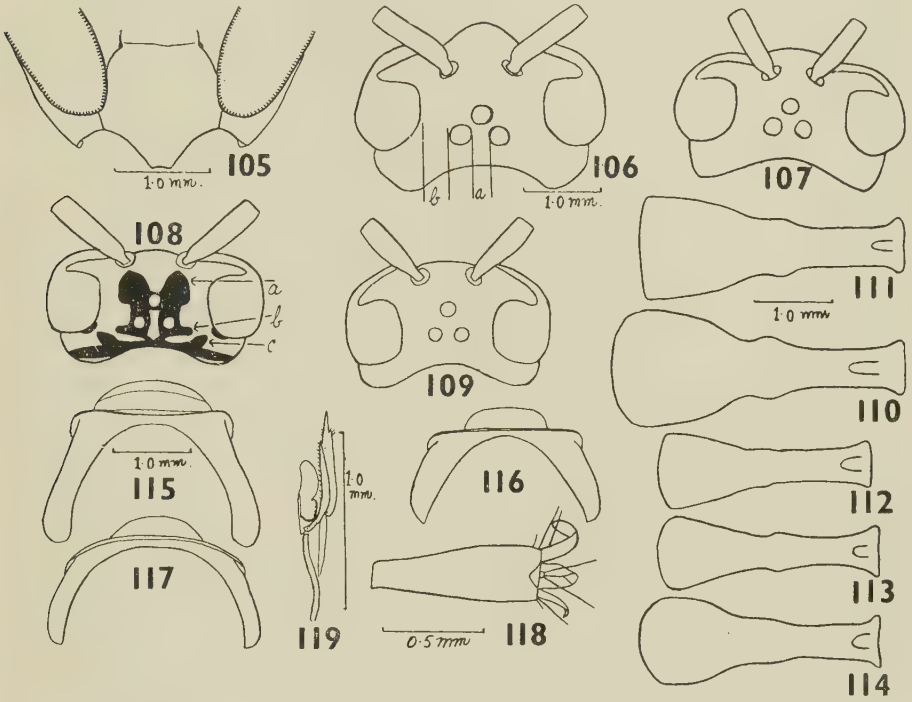
Mischocyttarus artifex (Ducke).

Megacanthopus artifex Ducke, 1914 : 327.

♀. Rather dark yellow; tip of mandibles and ventral margin of clypeus pitchy-red; antennae orange; ocellar and occipital marks very feebly indicated in brown, ocellar mark with traces of lateral " wings " at level of posterior ocelli; pronotum with very feeble brown marks in front of keel and on dorsal lobes; mesonotum with three ill-defined, black stripes; scutellum with narrow anterior margin and central line black, an ill-defined, central, brown cloud; postscutellum very narrowly margined with black in front and behind; propodeum with central line and antero-lateral triangles brownish-black; prepectus with furrow and spot beneath root of fore-wing brown; abdomen after petiole missing, petiole dorsally yellow-brown with posterior fifth yellow, ventrally yellow; according to Ducke (1914) the abdomen should be similarly coloured, *i.e.* yellow-brown with each tergite with a posterior yellow band. Tegulae orange-yellow with large external testaceous spot. Wings feebly infuscate, pterostigma yellow-brown. Surface of head and thorax with not very dense, short, pale pubescence which becomes brown on dark thoracic markings, ventral half of

clypeus with outstanding bristles; legs and abdominal petiole with microscopic, appressed, pale pubescence, tibiae and tarsi also with short, outstanding reddish bristles, petiole with very sparse outstanding pubescence laterally and ventrally. Length (H. + Th. + T1 + T2) probably about 12·0 mm.

Head dull but hardly perceptibly sculptured, ventral half of clypeus with sparse,



Figs. 105–19.

Fig. 105. Part of head with clypeus, *M. artifex* (Ducke) ♀.
106. Dorsal view of head, *M. artifex* (Ducke) ♀. (a) POL. (b) OOL.
107. The same, *M. oecothrix* Rich. ♀.
108. The same, *M. synoecus* Rich. ♀, dark markings shown. (a) Anterior process of ocellar mark. (b) Lateral wing of ocellar mark. (c) Process of occipital mark.
109. The same, *M. thrypticus* sp. n. ♀.
110. Dorsal view of abdominal tergite 1, *M. artifex* (Ducke) ♀.
111. The same, *M. oecothrix* Rich. ♀.
112. The same, *M. synoecus* Rich. ♀.
113. The same, *M. thrypticus* sp. n. ♀.
114. The same, *M. peruviensis* sp. n. ♀.
115. Pronotum in dorsal view, *M. artifex* (Ducke) ♀.
116. The same, *M. synoecus* Rich. ♀.
117. The same, *M. peruviensis* Rich. ♀.
118. Left hind claws in dorsal view, *M. synoecus* Rich. ♀.
119. Volsellar plate and parameral spine in ventral view, *M. oecothrix* Rich. ♂.

fine punctures. Mandibles shining with moderately numerous, shallow punctures, proximal half flattened and ventrally sharp-edged, four distal teeth. Malar space at narrowest between one-third and one-half width of antennal socket. Width of clypeus where eyes approach most closely three-quarters its length, ventral margin little depressed, strongly triangularly produced over almost its whole width, tip of production narrowly truncate, truncation as wide as antennal socket and defined by feeble teeth. Tentorial pits hardly

twice as far from antennal sockets as from eyes, well removed from both. Antennal sockets one and a third times as far from one another as from eyes. Antennal segment 3 as long as 1. Eyes separated ventrally by four-fifths as much as dorsally, in contact with clypeus for its ventral half. Ocelli in an equilateral triangle, separated from one another by rather less than diameter of one, POL : OOL = 1 : 2·5. Occiput not margined but with a pubescent fringe just below its dorsal limit, its width behind eyes dorsally about three times POL. Tempora one-half width of eye. Thorax + propodeum twice as long as broad, dull, almost without perceptible sculpture (very finely granulate). Pronotum with anterior margin strongly raised and reflexed, preceded by a furrow of which anterior edge is acute, laminate; no lateral fovea; keel strong, continuous, strongly concave anteriorly, not lobate at sides. Proepisternum with anterior margin somewhat raised, little reflexed, sides strongly margined. Upper division of metapleuron acutely produced along meso-metapleural suture. Tegulae almost entirely dull and pubescent, lateral margin somewhat truncate. Postscutellum obliquely flattened but not quite forming a continuous curve with scutellum. Propodeum with no anterior horizontal region, central furrow very weak with feeble central keel ventrally, lateral furrows obsolete, dorso-lateral margin of valve-plate acute. Mid tibia with two spurs of equal length. Mid tarsi with segment 3 strongly asymmetrical, segment 4 strongly produced. Hind tarsi with inner lobe of segment 3 much more strongly produced than outer lobe of segment 4, the outer edge of which is half as long as its inner edge; segment 5 a little longer than 2, claws very strongly asymmetrical, outer one broad and blunt. Length of fore-wing 14·0 mm.; hamuli 12. Abdominal petiole hardly as long as hind femur, sides parallel to spiracles, then strongly divergent but becoming somewhat less so before posterior margin, which is two and a half times as wide as anterior, spiracular ratio 3 : 4, spiracles moderately, obtusely projecting; petiole ventrally with membranous emargination four times as wide as deep.

♂. Antennae spirally coiled distally, segments 10–12 moderately, 13 very elongate, 3–13 with short curved dense cilia; sternites 4–6 with raised hyaline border. Hamuli 11.

Specimens examined:—Brazil: Guiana, Trombetas, R. Mapuera, 6.xii.1907, ♀ (*A. Ducke*) (Paris Mus.); Amazons, Obidos, 5.iii.1909, ♂♀ (*A. Ducke*) (♂ Paris Mus., ♀ B.M.).

All the above specimens were determined by Ducke and marked by him as type, but the holotype is probably in the Museu Goeldi. In the original description the type localities given are:—R. Mapuera and Obidos. Ducke (1914 : 315–6, fig. J), in describing this species, gives a photograph of the nest, which consists of a single row of cells.

Mischocyttarus oecothrix Richards, 1940 : 180.

♀. Yellow; margins of mandibles and ventral margin of clypeus pitchy; antennae orange, segments 1–2 blackish above, 1 yellow beneath; black ocellar mark produced to near antennal socket where its inner edge is emarginate, between ocelli with elongate yellow spot in the mark, lateral " wings " long, just behind middle of posterior ocelli, occiput with a long but rather narrow black, transverse line which sends process towards (though only reaching eye in three out of six spec.) eye, this process quite or almost meeting lateral wings; pronotum with black spot in front of keel and broad stripes on dorsal lobes; mesonotum black with two yellow discal stripes separated by rather more than their width, and lateral stripes abbreviated in front; scutellum with very narrow anterior and posterior margins and central line black, and a transverse brown discal cloud; postscutellum with narrow posterior black margin; propodeum with black central line, feeble antero-lateral brown triangles, and feeble brown lateral lines (darker in ventral depression); prepectal and dorsal furrows and hollow beneath root of fore-wing black; mid coxa with brown dorsal stripe, hind coxa with anteriorly incomplete outer and complete central, dorsal brown stripe; mid and hind legs after coxa mainly brownish tinged with tibia and femur distally yellower;

abdomen light reddish-brown with posterior quarter or fifth of tergites 1–5 and all sternites yellower. Tegulae testaceous with posterior yellow spot. Wings rather dark brown, especially along costa, venation brown. Surface of head and thorax with short, not very dense, appressed (or nearly) pale pubescence, ventral half of clypeus without outstanding bristles; legs and abdomen with dense microscopic appressed pale pubescence, tibiae and tarsi also with outstanding, reddish bristles, abdominal petiole with moderately close, outstanding pubescence at sides and beneath, other sternites with moderately distinct but shorter, outstanding pubescence, becoming dense on 5–6. Length (H. + Th. + T1 + T2) 10·0 mm.

Structurally resembles *M. artifex* (Ducke) except in the following particulars :—vertex with just perceptible punctures; malar space at narrowest one-quarter width of antennal socket; posterior ocelli separated by a little less than their diameter, POL : OOL = 1 : 3; keel of pronotum straight, a very little reflexed at extreme lateral extremity; ventral process of upper division of metapleuron subobtuse; propodeum with dorso-lateral margin of valve-plate acute (3 spec.), subacute (3 spec.); length of fore-wing 11·5–12·5, average 12·1 mm.; hamuli 10–12, average 10·8. Abdominal petiole less abruptly expanded, sides less divergent posteriorly; tergite 2 about as long as broad.

♂. Coloured like female but ocellar mark somewhat reduced; pubescence similar except on face below antennae, where it is dense, short and silvery and on sternite 7, where it is short, dense and outstanding. Length (H. + Th. + T1 + T2) 9·0 mm.

Structurally resembles female except :—mandibles hardly punctured, with three distal teeth, ventral one much the longest; clypeus relatively longer, ventral margin regularly rounded; tentorial pits almost touching eyes and much farther from antennal sockets; antennal sockets nearly twice as far from one another as from eyes; antennal segment 3 considerably longer than 1 + 2 or 4 + 5, nearly six times as long as broad, 4–10 gradually decreasing in length, 4 twice, 10 one and a third times as long as broad, 11 and 12 as long as 10 but thinner, 13 three times as long as broad, as long as 6, 3–5 fringed with close short cilia beneath, 6–9 somewhat emarginate beneath, distally antennae spirally rolled; eyes separated ventrally by half as much as dorsally, in contact with clypeus for two-thirds its length; tempora one-third width of eye; antero-dorsal margin of valve-plate of propodeum obtuse; length of fore-wing 11·0, 11·5 mm.; hamuli 8, 10; posterior margin of sternites 4–6 hyaline and somewhat upturned, sternite 7 flattened, somewhat foveolate; genitalia (fig. 117) described on p. 446.

Specimens examined :—British Guiana : Potaro R., Kaieteur Savannah, high forest, 6.ix.1937, ♂♀, allotype and type (nest 214) (*Richards and Smart*) (B.M.), Tumatumari, 29.vi.1927, ♀ (C.); Cattle Trail Survey, Canister Falls, xi.1919, ♂, 2 ♀ (*A. A. Abrahams*) (B.M. and Brit. Guiana Dept. Agric.); Essequibo R., Moraballi Creek, wallaba bush, 12.xi.1929, ♀ (*Oxford Univ. Exped.*) (B.M.). Peru : Col Perene, El Campamiento, 20.vi.1920, ♀ (C.).

The larva is described on p. 446.

I have examined one nest of this species, no. 214 (pl. 2, fig. 140), British Guiana : R. Potaro, edge of Kaieteur Savannah, Old Indian trail, 6.ix.1937, underside leaf of aroid, 3 ft. from ground. A second nest, no. 173 (pl. 2, fig. 152), Tukeit–Kaieteur trail, 3.ix.1937, underside leaf *Bromelia karatas* L., 2 ft. from ground, was deserted, but almost certainly belongs to the present species. Nest 214 is not now available but a diagram made at the time shows the arrangement of the cells and their contents. There are 32 cells which contained 18 eggs, 11 larvae and 2 pupae. 1 ♂, 1 ♀ were present. No. 173 is a grey-brown nest made of oval wood-fragments, some rather large; it is moderately varnished. The petiole is 15·0 mm. long, thin, hardly flattened. There is one row of 12 obliquely placed cells.

Mischocyttarus synoecus Richards, 1940 : 181.

♂♀. Resembles *M. oecothrix* Rich., except in the following characters :—yellow colour of head and thorax brighter, more sulphur-yellow; antennae black, segment 1 yellow, others orange beneath; ocellar mark brownish anteriorly in one specimen, sometimes narrowed anteriorly, sometimes broad, occipital mark connected to eye in three out of four specimens, lateral wings meeting occipital process in one specimen; scutellum with posterior half dark brown in one specimen; postscutellum with posterior black border broader (one-third to one-quarter its length), anterior margin of black nicked centrally; propodeum with antero-lateral triangles tending to be darker, full black in one specimen; pleural sutures yellow except small spot in hollow beneath fore-wing and small spot at centre of meso-metapleural suture; mid and hind coxa with markings darker, mid and hind trochanters largely black, hind femur and tibia with black dorsal streak, hind tarsi with segments 5 or 3–5 black; abdomen brown (sometimes quite dark brown) dorsally, with less distinct posterior yellow bands, or tergites 3–6 black, sternites yellow or 3–6 more or less dark; pubescence of abdomen largely blackish; length (H. + Th. + T1 + T2) 9·0–10·0 mm.

Posterior ocelli separated by a little more than their diameter, POL : OOL about 1 : 2·5; dorso-lateral margin of valve-plate of propodeum acute (3 spec.) or subacute (3 spec.); length of fore-wing 9·5–10·5, average 9·8 mm.; hamuli 7–11, average 9·2; abdominal petiole somewhat narrower and less expanded distally.

Specimens examined :—Panama : Canal Zone, Barro Colorado Is., 31.i.1929, ♀ (*S. W. Frost*) (J.B.), 17.vii.1924, ♀ (*N. Banks*) (J.B.). British Guiana : Potaro R., Amatuk, 31.viii.1937, 2 ♀ including type (nest 147) (*Richards and Smart*) (B.M.); Mazaruni Settlement, second-growth forest, 24.ix.1937, ♀ (nest 320) (*Richards and Smart*) (B.M.), 21.viii.1937, high forest, ♀ (nest 72) (*Richards and Smart*) (B.M.). Brazil : Guiana, Faro, 26.viii.1907, ♂ allotype, ♀ (*A. Ducke*) (P.) [marked as types of *M. cerberus* Ducke, cf. p. 444].

The larva is described on p. 446.

Three nests (pl. 2, figs. 144–6) of this species were examined. No. 147, British Guiana : Potaro R., Amatuk, 31.viii.1937, attached beneath mid-rib of leaf of small tree, 8 ft. from ground; no. 72, Mazaruni Settlement, high forest, 21.viii.1937, attached beneath mid-rib of leaf of small tree, 8 ft. from ground; no. 320, Mazaruni Settlement, second-growth forest, 24.ix.1937, attached beneath mid-rib of leaf 8 ft. from ground.

No. 147 was a greenish nest when fresh but is now yellowish-brown, made of closely placed small cylindrical objects (nature unknown, resembling caterpillar frass) embedded in a transparent layer, little varnished except on the petiole. The petiole is 6·0 × 1·0 × 0·5 mm., a little flattened at right angles to the long axis of the comb and parallel to the mid-rib. The small attachment-plate is 3·0 × 2·0 mm., and the whitish-transparent cone of attachment is rather large. The petiole is oblique to the proximal surface of the comb which is curved and little mammillated; the sides of the external cells are convex; the distal surface of the comb is uneven. The cells are arranged

$$\frac{\text{3 P. (1 C.), 4 (1 C.), 5 (1 C.), 4 (1 C.), 3, 2}}{\text{2 P. (1 C.), 4 (1 C.), 5 (2 C.), 5, 5}} = \text{21cells.}$$

The rows of cells are rather curved and new ones are added over much of the periphery farthest from the petiole. Completed cells are 14·0 × 4·0 mm. Eggs are laid 2·0–3·0 mm. from the bottom of the cell on the side nearest to the petiole. The cocoon-cap is flat, about flush with the distal end of the cell, made of white semi-transparent fibrous silk, with narrow bands of nest material.

One ♀ and one ♂ were present and the comb contained 8 eggs, 9 larvae and 4 pupae.

The two nests from Mazaruni were both whitish and made of small oval wood-fragments, varnished only on the petiole, but the nests were otherwise very similar to no. 147, except that the eggs were on the side of cells farthest from the petiole.

No. 72 had 2 P., 3, 2, 2 = 9 cells which contained 5 eggs and 3 larvae. One female was present and her ovaries contained 3 ripe eggs and her spermatheca was full of sperm. No. 320 consisted of 2 P., 2, 1 = 5 cells and contained 2 eggs and 1 larva. One female was present.

Mischocyttarus peruviensis sp. n.

♀. Bright yellow; margins of mandibles and ventral margin of clypeus pitchy; antennae black, segment 1 yellow, others orange beneath; ocellar mark extending to antennal socket where its inner edge is shortly but deeply emarginate, between ocelli with small elongate yellow spot, lateral " wings " long, extending more than half-way to eye, transverse black occipital mark long and broad, connected to ocellar mark and to eyes; most of pronotum in front of keel (three more or less fused spots) and broad stripes on dorsal lobes black; mesonotum black with four yellow stripes, median pair separated by more than twice their width, lateral pair abbreviated in front; scutellum with narrow anterior border and posterior two-thirds black, the black with straight anterior margin; postscutellum with posterior third black; propodeum with central stripe, antero-lateral triangles, ventral two-thirds of lateral stripes (including whole of depressions) black; spot in hollow beneath root of fore-wing, part of prepectal and dorsal furrows of mesopleuron, spot adjoining prepectus on mesosternum, meso-metapleural suture, whole metasternum, black; mid coxa with inner dorsal stripe and inner side black, trochanter and femur with black dorsal stripe; hind coxa with black inner, central and outer stripes (fusing anteriorly), dorsal side of trochanter and femur, proximal dorsal two-thirds of tibiae, anterior third of tarsal segment 1 and whole of 4–5, blackish; abdomen entirely black. Tegulae testaceous with posterior yellow spot. Wings almost quite hyaline. Pubescence as in allied species but somewhat more outstanding on vertex; length (H. + Th. + T1 + T2) 9·5 mm.

Structurally resembles *M. oecothrix* Rich., but differs as follows :—clypeus hardly longer than broad; posterior ocelli separated by about their diameter or a little less, POL : OOL = 1 : 3; pronotal keel not quite so strong, a little convex anteriorly, dying away more gradually at lateral extremities, which are not reflexed; valve-plate of propodeum acute; length of fore-wing 11·0 mm.; hamuli 8, 9; abdominal petiole about intermediate between *M. oecothrix* Rich. and *M. synoecus* Rich.

Specimens examined :—Peru : Col Perene, El Campamiento, 20.vi.1920, ♀ type (*Cornell Univ. Exped.*) (J.B.). Bolivia : Prov. Sara, ♀ paratype (*Steinbach*) (J.B.).

Mischocyttarus thrypticus sp. n.

♀. Pale sulphur-yellow with sharply defined black markings; margins of mandibles and ventral margin of clypeus pitchy-red; antennal segments 2–12 orange beneath; antennae dorsally, ocellar mark with broad, subrectangular anterior processes, just reaching antennal sockets, before which they are deeply emarginate, mark bearing an elongate yellow spot between ocelli, lateral " wings " short, occipital transverse line, rather narrow, extending more than half-way towards mandibles, connected to ocellar mark and posterior corner of eyes, black; pronotum with most of its dorsal surface in front of keel and large, subtriangular marks on dorsal lobes, black; mesonotum black with two discal, yellow stripes, separated by rather more than their width; scutellum with narrow anterior margin and small mushroom-shaped mark on posterior margin, black; propodeum with central stripe,

elongate antero-lateral triangles connected with narrow lateral stripes, black; mesopleuron with spot in hollow beneath root of fore-wing, postero-dorsal area, spot before bottom of prepectus connected to large ventral spot, black; metapleuron with ventral part of dorsal division, whole ventral division and metasternum, black; inner surface of mid coxa, cloudy marks on dorsal surface of trochanter and femur, black; hind coxa with complete outer dorsal and incomplete central and inner dorsal stripes, trochanter, femur entirely dorsally and proximally also ventrally, lobe of segment 4 and whole of segment 5 of tarsus, black; proximal two-thirds of abdominal segment 1 above and beneath proximal three-fifths of tergite 2 and three-quarters of 3–5 (posterior margin of the black straight), tridentate mark on sternite 2 and apparently some irregular marks on other sternites, black. Tegulae yellow with testaceous outer mark. Wings very slightly infuscate, costal cell yellowish, pterostigma yellow-brown. Surface of head and thorax with moderately close, short, appressed, pale pubescence, ventral half of clypeus with outstanding pale bristles; legs and abdomen with microscopic appressed pubescence, colour agreeing with that of integument, tibiae and tarsi also with outstanding, reddish bristles; abdominal petiole with sparse, outstanding pubescence beneath, other sternites with short pubescence, becoming longer and outstanding on 6. Length (H. + Th. + T1 + T2) 9·0 mm.

Structurally closely allied to *M. artifex* (Ducke) and *M. oecothrix* Rich., but :—clypeus not so much longer than broad; posterior ocelli separated by a little more than their diameter, POL : OOL = about 2·2; tempora hardly more than one-third width of eye; pronotal keel less strong, distinctly convex anteriorly, dying away very gradually at sides; valve-plates of propodeum with dorso-lateral margin acute; length of fore-wing 9·5 mm.; hamuli 8; abdominal petiole about as in *M. synoecus* sp. n.

♂. Resembles ♀ in colour and pubescence except :—antennal segments dorsally 1–7 black, 8–13 brown to orange; hind coxa with inner side and central stripe covered by continuous black mark; tergites 3–6 black with narrow, posterior yellow bands, 7 black. Clypeus with silvery, appressed pubescence. Length (H. + Th. + T1 + T2) 7·5 mm.

Structurally resembles ♀ except for sexual differences as in *M. oecothrix* Rich.; antennal segment 3 considerably longer than 1 + 2, or 4 + 5, five times as long as broad, 4–10 gradually decreasing in length, 4 twice, 10 three-quarters as long as broad, 11 hardly, 12 distinctly narrower but both about as long as 10, 13 about as long as 5, two and a half times as long as broad, no segment ciliated, but 5–10 with a broad area beneath somewhat more shining; dorso-lateral margin of valve-plate of propodeum acute; length of fore-wing 8·5 mm.; hamuli 7; sternites 3–6 with hyaline but not reflexed margins, 7 flattened with short pubescence; genitalia described on p. 446.

Specimens examined :—Paraguay : Alto Parana, type ♀, allotype ♂ (*F. Schade*) (J.B.).

7. (1) TABLE OF LENGTH OF FORE-WING

and

(2) TABLE OF HAMULI NUMBERS

(pp. 454–457).

7. (1) Table of Length of Fore-wing in Half-millimetre Classes of Species or Varieties of which more than four Specimens of the same Sex have been examined.

(*a*) *Mischocyttarus* s.s.

Species or variety	No.	11·0	11·5	12·0	12·5	13·0	13·5	14·0	14·5	15·0	15·5	16·0	16·5	17·0	17·5	18·0	18·5	19·0	19·5	20·0	Average
melanarius, ♀	33								1	3	5	11	1	2	4	5	0	1			16·4
,, ♂	20							1	0	2	1	3	0	5	2	3	2	1			16·9
labiatus, ♀	55					1	0	0	1	1	1	4	5	7	8	15	8	3	0	1	17·1
,, ♂	40					1	1	2	2	1	3	7	4	6	5	6	0	2	0	0	16·5
tomentosus, ♀	10							0	0	0	0	0	0	3	2	2	1	2			17·9
,, ♂	10							1	1	1	1	4	2	0	0	0	0	0			15·6
drewseni, ♀	45	2	0	6	7	9	6	6	1	8											13·3
,, ♂	25	1	2	4	6	8	2	1	0	1											12·7
gigas, ♀	4										1	0	1	2							16·5
rotundicollis, ♀	71		0	0	0	0	2	9	13	20	11	11	4			(+ 1 damaged)					15·1
,, ♂	11		1	0	1	0	3	4	1	1	0	0	0								13·6
gynandromorphus, ♀	8										4	2	0	1	0	1					16·1
flavicans, ♀	8										1	4	2	1							16·2
carbonarius, ♀	10							1	0	1	0	2	2	4							16·2

(*b*) Rest of *Mischocyttarus*.

	No.	7·0	7·5	8·0	8·5	9·0	9·5	10·0	10·5	11·0	11·5	12·0	12·5	13·0	13·5	14·0	14·5	Average
metathoracicus (all forms), ♀	15					1	1	4	4	4				(1 not recorded)				10·3
injucundus, ♀	8				3	3	0	1	1									9·1
bimarginatus, ♀	13			3	0	6	2	2										9·0
bertonii, ♀	5					2	3											9·3
ater, ♀	40					3	3	17	7	6	1	2	0	1				10·3
immarginatus, ♀	32					2	6	11	7	4	2							10·2
,, ♂	4					0	1	2	1	0	0							10·0
flavitarsis, ♀	11										1	1	3	3	3			12·8
idahoensis, ♀	9										1	2	2	1	2	1		12·7
centralis, ♀	6													3	0	1	2	13·7
pallidipectus, ♀	51				0	5	5	19	10	8	3			(+ 1 damaged)				10·2
,, ♂	17				1	1	2	7	4	1	0			(+ 1 not recorded)				10·0
hirsutus and *rufomaculatus*, ♀	5								2	2	0	0	1					11·1
tarmensis, ♀	30							0	0	1	3	14	11	1				12·1
,, ♂	9							1	0	4	1	2	1	0				11·3
wagneri, ♀	6			3	0	2	1											8·6
cassununga, ♀	59					8	19	19	12	1								9·8
,, ♂	6						3	3										9·8

| Species or variety | No. | 8·5 | 9·0 | 9·5 | 10·0 | 10·5 | 11·0 | 11·5 | 12·0 | 12·5 | 13·0 | Average | | |

7. (2) Table of Hamuli Numbers of Species or Varieties of which more than four Specimens of the same Sex have been examined.

(*a*) *Mischocyttarus* s.s.

Species or variety	No.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Average
melanarius, ♀ .	33					0	0	3	3	3	2	5	7	8	1	0	1	20·1
,, ♂ .	20					1	2	3	1	5	3	2	1	2	0	0	0	18·1
labiatus, ♀ . .	55		0	0	1	4	5	8	14	13	3	6	1					17·1
,, ♂ . .	40		1	1	6	9	4	6	8	3	2	0	0					15·3
tomentosus, ♀ .	10			0	0	3	2	3	0	1	1							15·7
,, ♂ .	10			1	3	3	2	1	0	0	0							13·9
smithii, ♂ . .	7					1	2	2	2									15·7
drewseni, ♀ . .	44			2	6	8	11	6	6	2	1	1	1	(+ 1 damaged)				15·3
,, ♂ . .	25			4	6	4	4	3	3	1	0	0	0					14·4
gigas, ♀ . .	4					1	0	1	2									16·0
rotundicollis, ♀ .	71		1	0	5	12	13	13	11	9	6	1						15·9
,, ♂ .	11		1	1	4	3	1	1	0	0	0	0						13·5
gynandromorphus, ♀	8					1	5	2										15·1
flavicans, ♀ . .	8			2	2	2	1	1										13·6
carbonarius, ♀ .	10	1	2	5	1	1												11·9

(*b*) Rest of *Mischocyttarus*.

Species or variety	No.	6	7	8	9	10	11	12	13	14	15	Average
metathoracicus (all forms), ♀ . .	15			2	6	6	1					9·4
injucundus, ♀ .	8			2	4	1	1					9·1
bimarginatus, ♀ .	13			1	7	5						9·3
bertonii, ♀ . .	5				2	2	1					9·8
ater, ♀ . . .	40			2	4	5	14	11	2	1	1	11·1
immarginatus, ♀ .	32			1	1	10	11	6	3			10·9
,, ♂ .	4					2	2					10·5
flavitarsis, ♀ . .	11				1	0	1	4	3	2		12·3
idahoensis, ♀ .	9					1	1	3	4			12·1
centralis, ♀ . .	6						1	1	2	1	1	13·0
pallidipectus, ♀ .	51		0	7	17	19	7	1				9·6
,, ♂ .	17		1	4	7	4	1	0				9·0
hirsutus and *rufomaculatus*, ♀ .	5			2	2	1						8·8
tarmensis, ♀ . .	30		1	17	4	8						9·0
,, ♂ . .	9		3	3	1	2						8·2
wagneri, ♀ . .	6		1	3	1	1						8·3
cassununga, ♀ .	59	0	8	30	14	5	2					8·4
,, ♂ .	6	1	1	2	2	0	0					7·8

paraguayensis, ♀	12			2	4	6			9·3
„ ♂	7			5	2	0			8·3
cubensis, ♀	14			2	2	4	4	1	1	10·2
„ ♂	4			0	2	0	2	0	0	10·0
mexicanus, ♀	19			4	3	4	5	3		10·0
„ ♂	5			0	2	1	0	2		10·4
angulatus, ♀	10		1	0	7	1	1	0		9·1
„ ♂	7		0	1	3	0	2	1		9·9
columbianus, ♀	13		0	2	5	5	1			9·4
„ ♂♀	5		1	1	3	0	0			8·4
costaricensis, ♀♂	9		1	3	4	1				8·6
basimacula, ♀	36			5	16	13	1	1		9·4
„ ♂	7			0	4	1	1	1		9·9
guatemalensis, ♀	4				2	2				9·5
superpictus, ♀	7		1	2	3	1				8·6
flavicornis, ♀	51			12	23	14	2			9·1
„ ♂	12			4	8	0	0			8·7
trinitatis, ♀	29			4	12	5	7	1	(+ 1 damaged)	9·6
bahiae, ♀	14		1	2	9	1	1		(+ 2 damaged)	8·9
zikanii, ♀	11			2	4	3	1	1	(+ 1 damaged)	9·6
phthisicus, ♀	15			1	7	6	1			9·5
punctatus, ♀	4			2	2					8·5
lecointei, ♀	51	1	2	15	18	15			(+ 1 damaged)	8·9
„ ♂	7	0	1	2	3	1				8·6
guianensis, ♀	7	1	3	1	1	1				7·7
metoecus, ♀	11		2	4	4	0	1			8·5
foveatus, ♀	7			3	4					8·6
sylvestris, ♂	5	2	1	2						7·0
cleomenes, ♀	4		1	3					(+ 1 damaged)	7·8
occidentalis, ♀	9		4	5						7·6
surinamensis, ♀	8		3	4	1					7·6

Species or variety	No.	7	8	9	10	11	12	Average
garbei, ♀	12	1	4	6	1			8·6
iheringi, ♀	5				3	2		10·4
acheron, ♀	12	5	5	2				7·6
oecothrix, ♀	6				3	1	2	10·8
synoecus, ♀	6	1	1	1	2	1		9·2
parallelogrammus, ♀	12		4	6	1	0	1	9·0
melanopygus, ♀	4		1	3				8·8
collarellus, ♀	28			5	9	8	8	10·6
superus, ♀	25	5	7	8	5			8·5
„ ♂	4	1	2	1	0			8·0

The following species described as *Mischocyttarus* by Zikán (1935, pages indicated below) from Brazil: Rio de Janeiro, Itatiaya (unless otherwise indicated) cannot be placed in their subgenus and species-group.

adjectus (p. 188); *clypeatus* (p. 192); *cryptobius* (p. 186); *declaratus* (p. 162); *duckei* (p. 196) *nec* du Buysson, 1908 (Amazons: Manáos) possibly belongs to the group of *M. ater* (Oliv.); *interjectus* (p. 175); *itatiayaensis* (p. 190); *mimicus* (p. 189); *mirificus* (p. 169); *paulistanus* (p. 176) (São Paulo); *similatus* (p. 187).

Further, I cannot place *Mischocyttarus ypiranguensis* Fonseca, 1926 : 181 (Brazil: Ypiranga).

Polybia plebeja Saussure, 1867 : 21, described from Mexico, is probably a *Mischocyttarus* according to Dr. J. Bequaert, but the type requires examination.

Polybia nigriceps Cameron, 1912 : 210, Demerara and *P. rejecta* var. *javaryensis* Cameron, 1906 : 152, Amazons, belong to *Polybia*; I have seen the types. The type of *P. traili* Cameron, 1906a : 382, Amazons, seems to be lost.

According to Dr. J. Bequaert, none of the species of *Polybia* described by Fox belongs to *Mischocyttarus*, other than those mentioned in the present paper. Thus Ducke wrongly identified as *P. centralis* Fox a species [Brazil: Rio Trombetas, 13.xii.1906, ♀ (Mus. nat., Paris)] of the group of *M. ater* (Oliv.) with strongly margined occiput.

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pallidipes sp. n., 366.
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parallelogrammus Zik., 418.
paulistanus Zik., 458.
pedunculatus Zik., 371.
peruviensis sp. n., 451.
phthisicus (Fab.), 400.
picturatus Beq., 347.
piger sp. n., 340.
plebeja (Sauss.), 458.
prominulus Rich., 425.
pseudomimeticus (Schulz), 348.
punctatus (Ducke), 404.
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rufidens (Sauss.), 385.
rufomaculatus var. n., 364.
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undulatus (Ducke), 338.
uniformis Beq., 352.
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violaceipennis (Cam.), 327.
wagneri (Buyss.), 371.
xanthocerus var. n., 439.
ypiranguensis (Fonseca), 458.
zikanii var. n., 399.

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Explanation of Plates 1–4.

Plate 1. Figs. 120–139.

Fig. 120. *Mischocyttarus sylvestris* sp. n., nest 1813.
121. *M. cleomenes* sp. n., nest 397.
122. *M. wagneri* (Buyss.), nest 404.
123. *M. pallidipectus* (Smith), nest 405.
124. *M. foveatus* Rich., nest 4070.
Figs. 125–6. *M. lecointei* var. *guianensis* var. n., nests 2339, 2312.
127–9. *M. basimacula* (Cam.), nests 393, 394, 395.
Fig. 130. *M. alfkenii* var. *trinitatis* var. n., nest 399.
131. *M. alfkenii* var. *excrucians* var. n., nest 398.
132. *M. angulatus* sp. n., nest 400.
133. *M. prominulus* Rich., nest 75.
134. *M. injucundus* (Sauss.), nest 116, on mango leaf.
135. The same, seen from above.
136. *M. rotundicollis* (Cam.), diagram of nest 403 (cf. Plate 2, fig. 141). The numbers show the probable order in which the cells were constructed. Cross-hatching shows cocoons and the black dot the position of the petiole.

Fig. 137. *M. metoecus* Rich., diagram of nest 261 (Plate 3, fig. 166), showing positions of eggs (small ovals), larvae (larger ovals), pockets where new cells are being added, and processes from floor of cells.
138. The same, diagram of nest 337 (Plate 3, fig. 169).
139. The same, diagram of nest 148.

Photographs 120–134 on one scale, 135 on another.

Plate 2. Figs. 140–154.

Fig. 140. *M. oecothrix* Rich., diagram of nest 214; showing positions of eggs (small ovals), larvae (larger ovals) and cocoons (cross-hatched).
141. *M. rotundicollis* (Cam.), nest 403 (cf. Plate 1, fig. 136).
Figs. 142–3. *M. surinamensis* (Sauss.), nests 93, 184.
144–6. *M. synoecus* Rich., nests 27, 147, 320.
147–9. *M. cerberus* var. *acheron* Rich., nests, 129, 265, 289.
150–1. *M. cerberus* var. *styx* Rich., nests 401, 402.
Fig. 152. *M. oecothrix* Rich., nest 173.
Figs. 153–4. *Mischocyttarus* sp. 10, nest 321, two views.

Photographs all to one scale, except fig. 141.

Plate 3. Figs. 155–180.

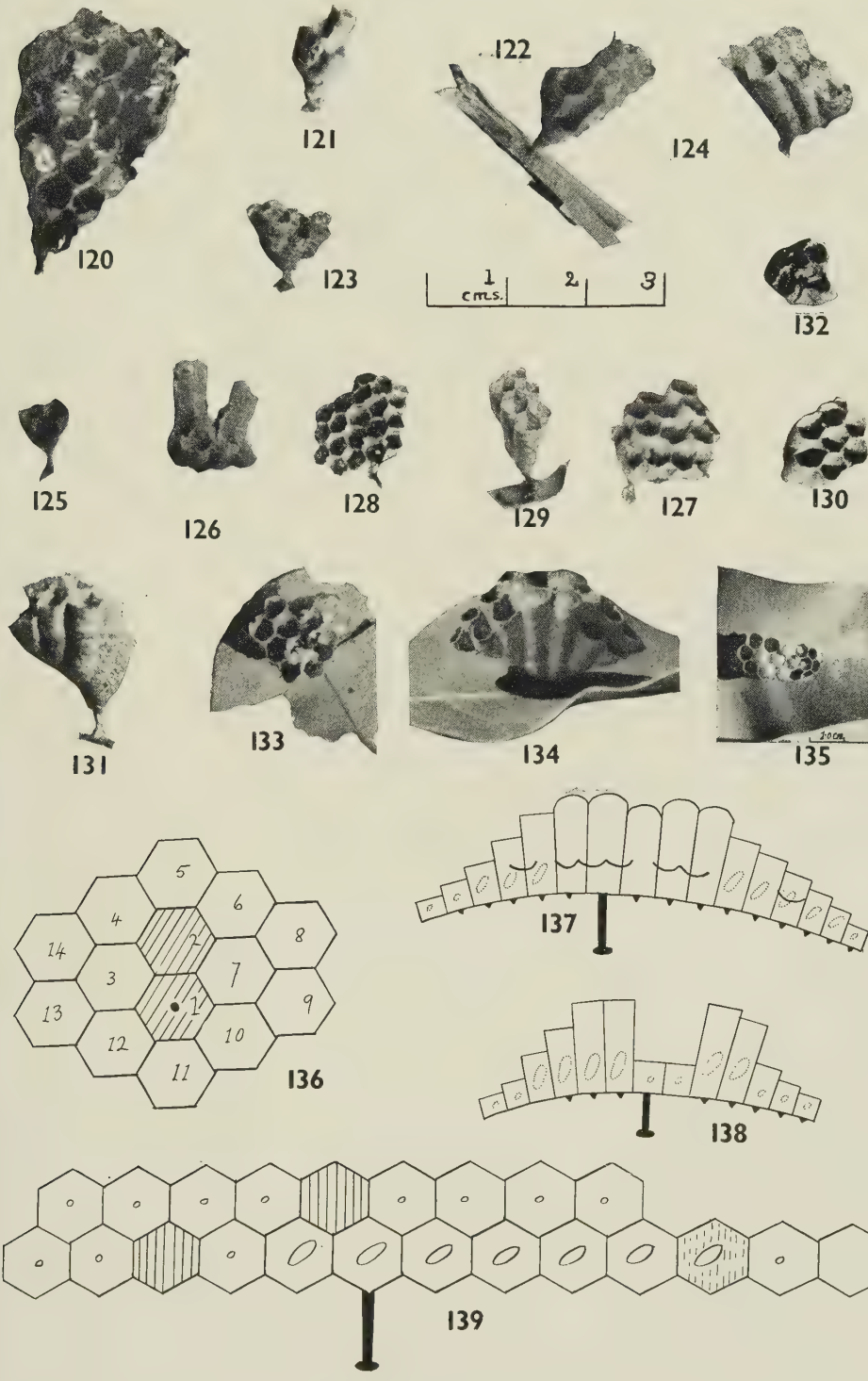
Fig. 155. *M. heliconius* Rich., nest 151.
Figs. 156–60. *M. lecointei* (Ducke) nests, 174, 177, 179, 239, 245.
161–5. *M. ater* (Sauss.), nests 406, 407, 408, 409, 410.
166–9. *M. metoecus* Rich., nests 261, 262, 319, 337. Cf. Diagrams 137–139, Plate 1.
170–9. *M. collarellus* Rich., nests 141, 183, 227 (1929), 277, 284, 295, 297, 318, 344, 348.
Fig. 180. *M. collaris* var. *parallelogrammus* Zik., nest 416.

Photograph 155 one scale; 156–65, another; 166–9, another; 170–80, another.

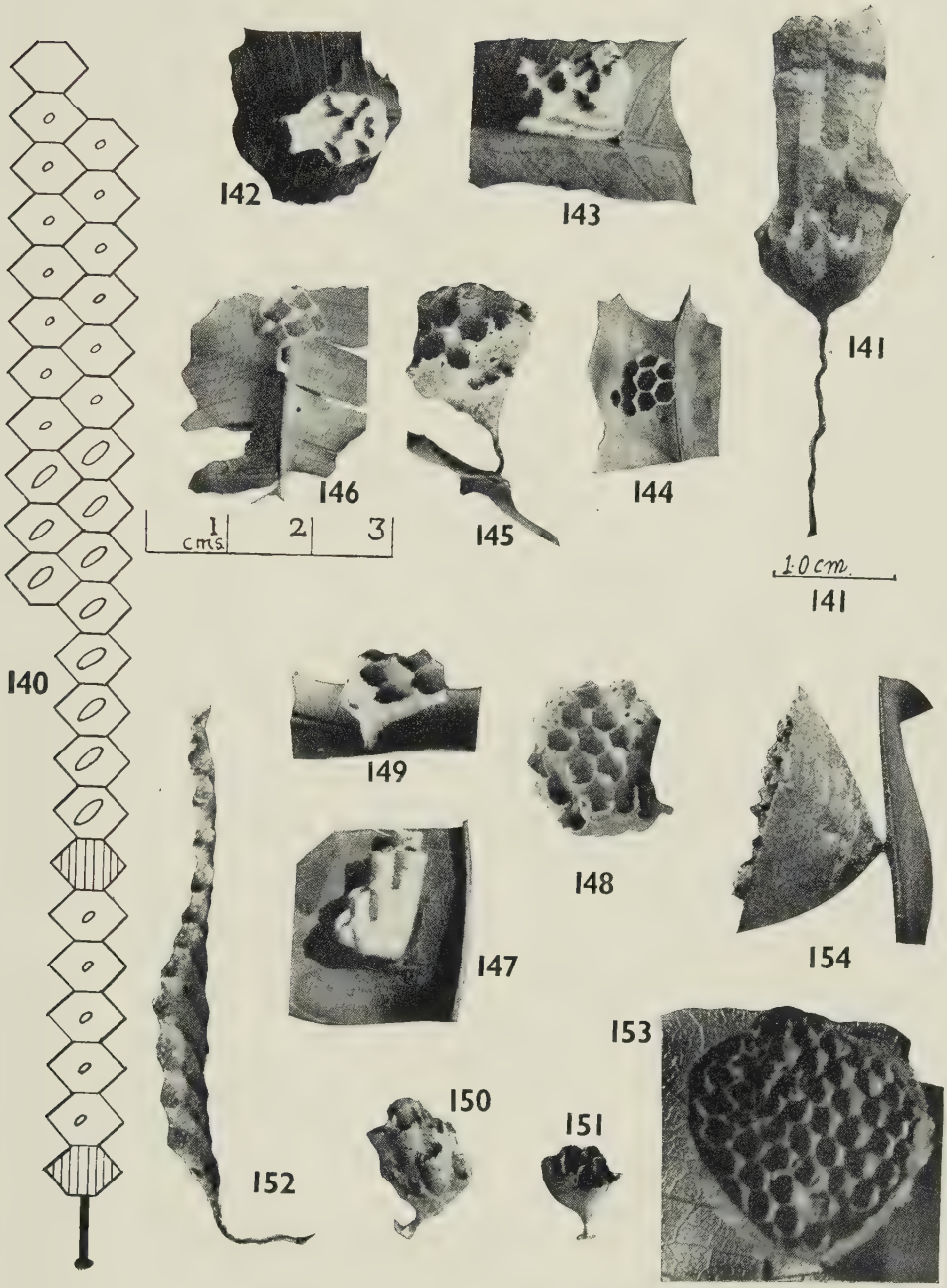
Plate 4. Figs. 181–194.

Figs. 181–2. *M. carbonarius* (Sauss.), nests 188, 230.
183–4. *M. injucundus* (Sauss.), nests 138, 3626.
Fig. 185. *Casearia* sp. (small tree, Flacourtiaceae), near Mazaruni Settlement, ix.1937. On the leaves of the tree were nests of the ant *Azteca* sp., and of *Mischocyttarus metoecus* Rich.
Figs. 186–94. *M. superus* Rich., nests 16, 17, 51, 107, 134, 150, 220, 260, 296.

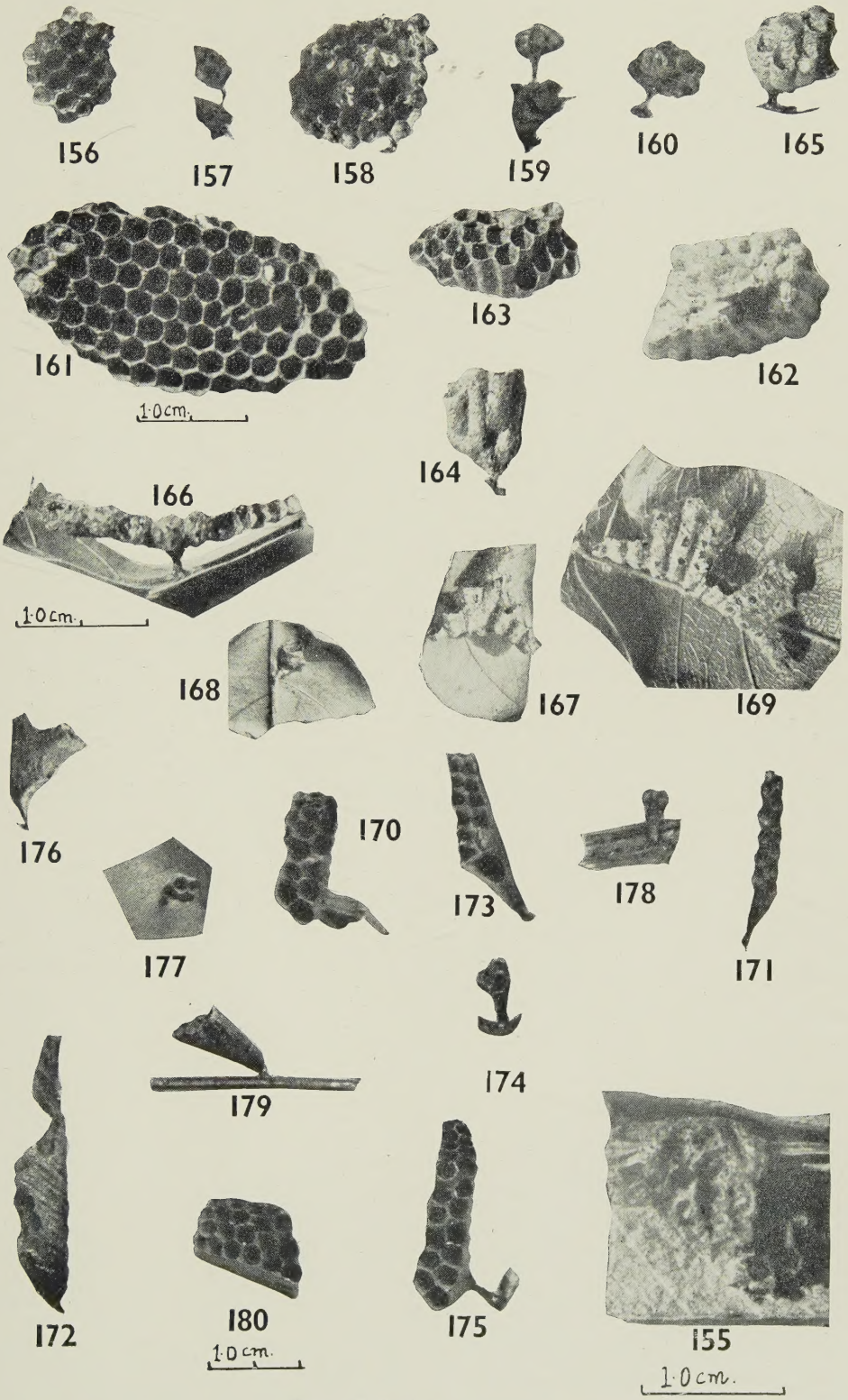
Photographs of nests of each species to a different scale.



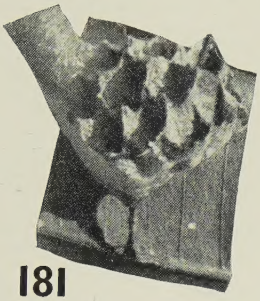
Nests of *Mischocyttarus* spp.



Nests of *Mischocyttarus* spp.



Nests of *Mischocyttarus* spp.



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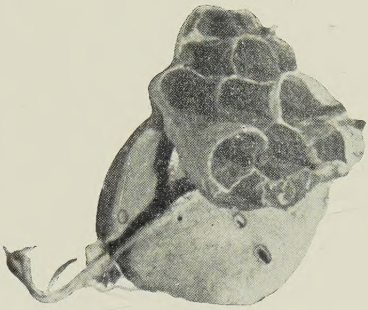

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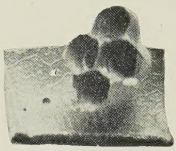

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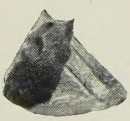

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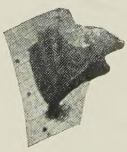

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Nests of *Mischocyttarus* spp.